Technology, Public Policy, and the Changing Structure of American Agriculture

Volume II—Background Papers

Part C: Agricultural Finance and Credit

1. Credit Policy and Structural Issues in Agriculture
2. Tax Policy, Technology, and the Structure of Agriculture
3. Overview of Capital and Credit Markets Serving Agriculture: Their Impact on Technology Adoption and Structural Change
4. Regulatory and Performance Issues for Financial Institutions: Their Effects on Technology Adoption and Structural Change in Agriculture
5. The Role of Federal Credit Assistance Programs in the Process of Technological Change
6. Short Term Credit Policies for Dealing With Farm Financial Stress and Their Impacts on Farm Structure and Adoption of New Technology

May 1986

These Contractor Documents were prepared by outside contractors as an input to an ongoing OTA assessment. They do not necessarily reflect the analytical findings of OTA, the Advisory Panel, or the Technology Assessment Board.

CONGRESS OF THE UNITED STATES
Office of Technology Assessment
Washington, D.C. 20510

J952-57

Technology, Public Policy, and the Changing Structure of American Agriculture
Volume II--Background Papers

Part C: Agricultural Finance and Credit

Paper No.

1. Credit Policy and Structural Issues in Agriculture by Peter J. Barry

2. Tax Policy, Technology, and the Structure of Agriculture by Hoy F. Carman

3. Overview of Capital and Credit Markets Serving Agriculture: Their Impact on Technology Adoption and Structural Change by David A. Lins

4. Regulatory and Performance Issues for Financial Institutions: Their Effects on Technology Adoption and Structural Change in Agriculture by Peter J. Barry

5. The Role of Federal Credit Assistance Programs in the Process of Technological Change by David Trechter and Ronald Meekhof

6. Short Term Credit Policies for Dealing with Farm Financial Stress and Their Impacts on Farm Structure and Adoption of New Technology by John R. Brake

Background Paper No. 1

Credit Policy and Structural Issues in Agriculture

Peter J. Barry
University of Illinois

March 1983

Office of Technology Assessment
U.S. Congress

A paper prepared for the Policy, Technology, and Structure of Agriculture Workshop sponsored by the Office of Technology Assessment, March 23-24, 1983, Washington, D.C.

This background paper was prepared for the assessment "Technology, Public Policy, and the Changing Structure of American Agriculture." The views expressed are those of the author(s) and not necessarily those of OTA.

Credit Policy and Structural Issues in Agriculture

Peter J. Barry
Professor of Agricultural Finance
University of Illinois

This paper considers the relationships that exist among farmers' credit use, credit policies, and various structural issues in agriculture. The following sections highlight the importance of these relationships, consider the role of technology, review some of the prevailing views on credit policy and structural issues, and consider the implications for additional information.

Importance of Farm Credit

Farmers in the U.S. have long used credit and related services provided by financial institutions that differ greatly in their sources of funds, specialization in farm lending, legal and regulatory environment, and government affiliation. Included are the Cooperative Farm Credit System, government lending agencies and credit programs, farm input suppliers, life insurance companies, the commercial banking system, and individuals, especially sellers of farm land. Rapid growth in farm debt (8 percent annually in the 1960s and 12 percent annually in the 1970s) has contributed greatly to the efficient production and marketing of farm commodities; to replacing, modernizing, restructuring, and expanding the capital base of farming operations; and to meeting household needs. Moreover, credit reserves are one of farmers' most important sources of liquidity in responding to business risks in

agriculture. These reserves provide the capacity to carry over loans, defer payments, and refinance high debt loads during times of financial stress.

Thus the financial performance of many farming operations--especially the larger, more commercial ones--has depended on loan funds that are made available in a timely fashion, for various purposes, and in amounts, costs, and maturities that compare favorably with terms available to other economic sectors. This important role of credit means that it has significance for most if not all of the attributes which comprise the "structure of agriculture." But, as we shall see, the nature and importance of these relationships are less clear and need further consideration.

It is useful to first consider the structure of agriculture from two distinct vantage points. One is a broad vantage point that contrasts the organizational characteristics of a) a large-scale, corporate industry with concentrated and dispersed ownership of equity claims, versus b) an industry or sector with a smaller-scale, non-corporate, more atomistic organization of resource ownership and control. This vantage point is conducive to inter-industry comparisons.

The other vantage point considers the structural changes that have occurred within a particular industry, given its broad organizational characteristics. Here, a focus on the U.S. farm sector would consider the changes that have occurred within an industry largely having a smaller-scale, non-corporate organization of ownership and control.

From its early days, the U.S. farm sector has worked toward and

succeeded in retaining its smaller-scale, non-corporate organization, despite the widespread industrialization and expansion of corporate organizations in other sectors of the economy. Certainly some exceptions occur like broilers, some cattle feeding, and some types of agriculture in California and other regions. But in general, the farm sector has avoided these changes. While doing this, however, the sector has also achieved great gains in productivity, mechanized operations and adopted other forms of technology, and further developed farmers' managerial skills.

Credit has played a valuable role in retaining these broad industry characteristics--including the credit policies of the government. These policies include the development, updating and administration of stable, low cost, comprehensive, nationally-oriented sources of debt capital for farmers and their cooperatives--authorizing and supervising the Cooperative Farm Credit System including the agency status of its securities, developing special banking and commerce laws, and offering direct credit services through the Farmers Home Administration and the Commodity Credit Corporation. Other programs that provide insurance and help reduce farming risks have also contributed to the availability of credit and related services for agriculture. Without these special credit programs and activities, it is doubtful that the non-corporate, smaller scale organization of farm units could have survived.

The effects of financial capital on structural changes <u>within</u> the farm sector are less clear. Consider the larger farm sizes, fewer farm numbers, greater specialization, greater capital intensity, stronger

market coordination, substantial leasing of farmland, declining liquidity, higher more rigid leverage, and increasing entry barriers. Have financial markets lead some of these patterns, or simply accommodated them? Or, are the relationships more complex? Are structural changes in the farm sector and its sources of financing jointly dependent?

Answers to these questions are neither simple or straightforward. It does seem reasonable, however, that availability of credit has been a necessary condition for financing the kinds of investments and activities that result in structural change. But it is unlikely that the availability and terms of credit alone provide enough stimulus to prompt structural change. Instead, economic incentives and the promise of their fulfillment are needed, along with the necessary attributes of credit worthiness for the investors involved. As we shall see, however, special credit programs and concessionary terms may tend to over-facilitate change and contribute to fallacious or illusionary incentives that hamper long term resource adjustment.

Role and Importance of Technology

The importance of technology on credit policies and their relationship to structural issues in agriculture is not very definitive. It depends upon how broadly technology is defined--that is, whether it includes the changes in institutions, instruments, and practices that comprise the financial markets. Several major areas involving technology can be defined. One is farmers' use of computers and information systems

in storing and retrieving financial data about their operations, analyzing financial performance, and reporting results to lenders in order to establish their credit worthiness. Computer-assisted planning techniques are also relevant; they include the financing implications of farm investments, cash flow budgets, marketing policies, enterprise organizations, and so on. Here, the major point is that computer use appears to be growing significantly among farmers, including its role in financial planning and credit management. Moreover, it is likely that computerization is more prevalent in larger operations with more complex organizations.

Another area involves the indirect effects of technology in reducing the transactions costs and improving the overall efficiency of providing credit to farmers and their cooperatives. Here, the focus is on farm lenders (public and private) and their use of electronic funds transfers, computerized information systems, credit scoring techniques, overdraft and credit card systems, and the growing use of computers in pricing loans and other services. These types of technological developments have contributed importantly to linking farmers' credit needs to nonlocal sources of funds in the national and international financial markets. They have also made farmers more vulnerable to the forces in these markets, and are compelling farmers to compete for loan funds on terms that will be increasingly comparable to other commercial borrowers.

Still another area relates to regulatory changes in financial markets, revisions in authorizations for farm credit institutions, and

financial innovations that influence the cost and availability of credit for farmers. These will be considered further below.

Credit Policies and Structural Issues: Empirical Information

The number of studies in recent times that have explicitly considered the relationships between credit policies and structural issues appears quite limited. Included are: 1) "Credit Policy," chapter 8 in A Time to Choose, published by the U.S. Department of Agriculture; 2) "Availability of Financial Capital as a Factor of Structural Change in the U.S. Farm Production Sector (Lins and Barry), in Farm Structure, published by the Committee on Agriculture, Nutrition, and Forestry of the U.S. Senate; 3) "Financing and the Structure of U.S. Agriculture" published by the Farm Credit Administration; and 4) "Public Policy Toward Agricultural Credit" (Lee, Gabriel, and Boehlje), published by the Federal Reserve Bank of Kansas City. However, many other papers and studies have considered various aspects and implications of the credit-structure relationship. Some of these observations are included below.

First, however, it is useful to give some descriptive data about farm credit use in terms of several structural characteristics, using results from the 1979 Farm Finance Survey. As of December 31, 1979, 53.8% of the 2.35 million farmers in the U.S. had outstanding debt. On a regional basis this figure ranged from 46.3% of the farmers in the South to 60.3% in the North Central region. Among states the range was from 31.1% in West Virginia to 72.7% in Iowa.

Among size classes, two types of measures are available. More than 80 percent of farmers with gross sales above $100,000 (12% of total farmers) had debt, while less than 40% of the farmers with gross sales less than $5,000 (37% of the total farmers) had debt. Similarly, more than 70% of farms with more than 500 acres (15% of the total) had debt, while less than 50% of the farmers with less than 180 acres (61% of the total) had debt.

Of full-owner farmers, 45.9% had debt--full owners comprised 60% of the total farms and controlled 30% of the total farm land. Of part-owner farmers, 71.8% had debt--part owners comprised 27% of the total farms and controlled 58% of the total farm land. Of tenant-farms 52.2% had debt--tenants comprised 13% of the total farms and controlled 12% of the total farm land.

For the types of business organization, 52.7% of the individual or family operations held debt, and comprised 89% of all farms; 60.0% of farm partnerships held debt, and comprised 9% of all farms; and 72.8% of farm corporations held debt, and comprised 2% of all farms.

For the age distribution of farmers, 70.7% of farmers less than 35 years old held debt, and comprised 15.7% of the total farms; 37.5% of farmers who were age 55 or older held debt, and comprised 41.8% of all farms.

The distribution of debt to asset ratios among selected characteristics of farm structure is shown in Table 1. Again, these data indicate that the larger farms and younger farmers tend to operate with the higher levels of financial leverage, so that data about average leverage for the farm sector as a whole are not very meaningful.

The final descriptive item involves the distribution of farm debt from various farm lenders among farms classified according to their level of gross sales for 1979. Here again, it is clear that all of the farm lenders tend to concentrate their debt in the larger sale classes, although some interesting differences occur among the lending groups. Life insurance companies mostly finance larger farms with more than two thirds of their loans held by farmers with sales above $200,000. About 58% of Federal Land Bank loans and 67.5% of PCA loans are held by farms with gross sales above $100,000. In contrast, 54.9 % of commercial banks' loans are held by farms with sales above $100,000, indicating that somewhat higher proportions of bank debt are held by the smaller size classes of farms. Similar relationships hold for merchant and dealer financing. Even the debt outstanding to the Farmers Home Administration and CCC was concentrated in the middle range of these size classes for gross sales.

Now, let's consider some of the studies about credit policies and structure. The findings in A Time To Choose are summarized as follows. The report argues that the modern, industrialized, high-technology agriculture was built, in large part, on abundant supplies of relatively cheap financial capital. To some extent, the cheap capital was provided directly by Government credit programs; in other cases, the effects on financing costs were less direct as in programs that reduced farming risks and thus credit risks for commercial lenders, and in policies that have improved the workings of money markets and lending institutions. These developments have had many beneficial effects.

But some of the corollary effects of these credit policies are less desirable. Over a long period of time, we have seen incentives arise for consolidation and growth in farm size as results of a) downward pressures on profit margins from credit-induced increases in production, and b) larger farm sizes needed to efficiently use new machines, equipment, buildings, and other forms of new technology

In addition, the accompanying trend toward more specialization in farm production and greater use of debt has increased farmers' risk positions, made them more vulnerable to traditional farm risks as well as to instabilities in financial markets, and, paradoxically, eventually increased many farmers' need for public assistance. Then, when the assistance occurs as more liberal credit, these effects are further exacerbated.

The USDA report echoes the observations of others (Lee, et al) that the past structure of farm credit markets, including the prominence of government programs, has resulted in over-financing of the farm sector, shifting too much risk bearing to the government, and capitalizing the effects of concessionary financing terms into higher values of land and other farm assets. Additional evidence along these lines is provided by other studies. One view is that larger farms may benefit from the government's active role as a risk bearer through bidding advantages for land, tax factors, greater financial capacity for growth, and greater capacity to service debts on relatively favorable terms. Another view is that public policies (including credit) which over time have contributed to real growth in farmers' income have made more of

farmers' returns occur as capital gain relative to current income, especially when the policy benefits are bid into land values. The resulting liquidity problems are further worsened by continued efforts to enhance farm income, due mostly to the dominance of land and other fixed assets among the total assets of farm businesses.

My paper with David Lins attempted to relate credit policies to several of the specific structural characteristics in agriculture. Despite the absence of hard evidence, several lines of relationship could be established. The pronounced move to fewer and larger farms in the U.S. clearly appeared to be facilitated by readily available credit. This structural change likely resulted in a more technically efficient agriculture, although several studies have shown that the incentives for achieving technical economies of size with substantial growth are small, or even non-existent.

Tenure patterns have also likely been influenced by credit policies. Readily available credit, especially real estate credit, has likely been important in the growing proportion of farm operators who are part owners and, to a lesser extent, full owner of the land they operate. Lenders still strongly favor collateral among the determinants of credit worthiness, so farmers respond with a balance of leasing and ownership as part of their strategies for growth and expansion.

There is little evidence about the influence of credit on different types of farms (dairy, grain, livestock) and the level of specialization in U.S. agriculture, although increasing specialization appears to have accompanied the growth in farm sizes. Many commercial

lenders also appear to have favored the collateral, marketability, and cash flowability of livestock production and feeding operations, compared to the lower liquidity and longer term production processes of many crop operations. Moreover, the availability of external equity capital substantially influenced some of the past changes in cattle feeding and orchard enterprises, due in part to tax shelters. Changes in tax laws along with the business risk characteristics of these enterprises has demonstrated the instability of external equity financing.

Credit factors also appear less important in farmers' choice of business organization (partnership, corporation, etc.) or in other use of contracting and other means of market coordination. However, farmers' inventory management for many crops and greater flexibility in marketing have benefitted from the lending programs of the CCC. Moreover, the risk-reducing features of these marketing strategies tend to improve farmers' availability of credit from commercial sources, and perhaps reduce its cost. Moreover, in farm cooperatives which take on much of the marketing function for farmers, their use of and access to credit may exceed that of individual farmers, and be less costly as well for borrowing from Banks for Cooperatives in the Farm Credit System.

In its own views, the Farm Credit Administration sees credit as playing a facilitating role in the process of structural change, primarily affecting the rate of structural change. They argue that credit institutions should play a neutral role in the borrowers' managerial decisions, except when the safety of the loan is involved. They view that credit is not an appropriate vehicle for changing the structure of agriculture

and that government credit should be viewed as temporary for individual borrowers, focussing on fostering entry in selected cases, providing a bridge out of extreme disaster situations, avoiding the distortion of price signals in financial markets, and be carefully monitored with respect to limits on loan size, funds use, and graduation requirements into the commercial credit market.

Implications

A major theme of most of the studies and observations cited above is credit's facilitating role in financing the kinds of investments and activities that have resulted in structural change in agriculture--while still fostering the sector's smaller scale, noncorporate organization. Moreover, credit programs and concessionary terms indeed can be instruments for structural change, although the secondary effects on farmers' risk and liquidity positions, asset values, and longer term adjustment for some resources may on balance tend to outweigh the intended positive effects. In this light, the Farm Credit Administration's view that credit is not an effective vehicle for structural change is significant.

An important research implication is that many of the relationships between credit and structure are based on limited evidence, experienced judgment, and casual impressions. The relationships may seem valid but more definitive information is needed about credit's role relative to other factors, as well as about the micro-macro linkages. How much of the farm sector's smaller scale organization is due to credit policies compared to price and income support policies, intergenerational

linkages, non-pecuniary motivations of farmers, special management factors, and socio-economic pressures discouraging corporate intervention in farming? How much of higher land values is due to credit terms versus the bidding effects of support and stabilization programs, size economies, and the long term growth of return to farm assets? How have emergency loans to help farmers with near term adversities affected longer term risk positions? How do we distinguish between farmers who manage and control leverage effectively, versus those who are "managed and controlled" by leverage? We may believe that liberal credit has slowed adjustment and brought further financial problems, but definitive evidence is lacking.

Another major point is that difference in credit use among farms with different structural characteristics hampers generalizations about these relationships. Some of these relationships are subtle and difficult to measure. Diversified farms, for example, may have higher financial leverage (and thus financial risk) because of less business risk compared to specialized farms. If so, higher leverage does not imply easier credit for these farms; rather, it reflects a financial response to the differences in business risks. Farmers who effectively manage market risks through hedging, contracting or inventory management may also achieve higher leverage--due to the risk reduction, not due to financial market imperfections. Larger farms may experience economies of size in risk bearing and credit management which enhance their financial performance and debt carrying capacity. Finally, credit use also depends on farmers' willingness to bear risks. Generally, farmers

with more debt are considered less risk averse so that leverage varies with farmers' risk attitudes. Hence, in principle, credit limits in loan programs are better based on credit worthiness than on administered limits. Even entry into farming may be better removed from credit issues and left to market forces.

Another need for further analysis involves the relationships between the deregulation of financial markets, the availability of credit services for farmers, and the structural consequences. Consolidation in the number, size, and control of rural banks may continue to occur as competition in banking markets increases, and as geographic restrictions are liberalized. Farm lending activities, may tend toward greater concentration in banks with $50 million to $100 million in total assets, with larger farming operations seeking these larger banks. In turn, the banks' financing of smaller farms may lessen. Larger banks with more complex legal structures also use more sophisticated methods of pricing farm loans and evaluating loan profitability. Thus farmers and other rural borrowers should anticipate pricing policies and credit evaluation procedures that are more common in commercial lending, with structural consequences leaning toward more commercialization of farming activities.

Profound structural consequences for agriculture could also arise from possible changes in the "agency status" of the securities which the Farm Credit System sells in the financial markets. The government has studied the agency status issue with a view toward shifting credit to completely private status, where possible. The agency status of

Farm Credit Securities, however, appears to be a necessary condition for maintaining the System's efficient access to national and international markets, and for providing stable, cost effective diverse credit services for farmers. A recent study revealed that the loss of agency status for Farm Credit bonds and discount notes could significantly reduce the marketability of these securities and increase the cost of issuance. If these regulatory changes do occur, they could have major impacts on the FCS, its farm borrowers, and credit demands from other lenders.

Table 1. Distribution of Debt-to-Asset Ratios by Selected Structural Characteristics

	Farms with Debt-to-Asset Ratio of--*				
	Less than 6 Percent	6 to 10 Percent	11 to 20 Percent	21 to 40 Percent	41 to 100 Percent
	%				
United States	55.9	7.2	11.4	13.1	11.6
Sales Class					
$500,000 or more	19.5	6.9	14.4	26.1	28.9
$100,000 or more	26.3	8.2	17.2	23.2	23.3
Less than $2,500	71.3	5.7	8.7	9.0	5.2
Age of Operator					
Less than 35	25.5	5.9	10.3	16.3	28.5
55 and above	74.2	6.1	8.0	6.8	4.5

*Excludes farms with debts greater than assets

Source: 1979 Farm Finance Survey

Table 2. Distribution of Farm Operator Debt Among Gross Sales Categories, Classified by Farm Lender, Dec. 31, 1979

Values of Farm Products Sold	Individuals, Land Debt	Life Insurance Companies	Federal Land Banks	Production Credit Assn.	Commercial Banks	Merchant & Dealer	Farmers Home Adm.	Commodity Credit Corp.	Individuals Other
					%				
$500,000 or more	10.8	40.3	15.1	24.0	21.1	12.7	8.6	9.7	21.9
$200,000 to $499,999	15.2	28.7	19.8	23.4	15.5	17.9	14.1	18.8	21.3
$100,000 to $199,000	21.5	14.8	23.4	20.1	18.3	21.7	22.9	24.8	21.7
$40,000 to 99,999	24.2	10.6	22.7	19.7	20.6	22.2	32.4	35.8	19.3
$20,000 to $39,000	7.2	2.3	7.5	6.0	6.1	9.2	10.9	7.4	6.0
$10,000 to $19,999	7.0	1.6	3.9	2.6	5.3	6.5	5.0	2.6	4.7
$ 5,000 to $9,999	4.7	0.7	3.3	2.5	3.7	3.9	2.7	0.6	2.0
$ 2,500 to $4,999	4.3	0.3	2.2	1.1	2.7	3.0	2.0	0.2	0.7
Less than $2,500	5.1	0.5	2.1	0.6	6.7	2.9	1.4	0.1	2.4
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: 1979 Farm Finance Survey

Background Paper No. 2

Tax Policy, Technology, and the Structure of Agriculture

Hoy F. Carman
University of California-Davis

March 1983

Office of Technology Assessment
U.S. Congress

A paper prepared for the Policy, Technology, and Structure of Agriculture Workshop sponsored by the Office of Technology Assessment, March 23-24, 1983, Washington, D.C.

This background paper was prepared for the assessment "Technology, Public Policy, and the Changing Structure of American Agriculture." The views expressed are those of the author(s) and not necessarily those of OTA.

TAX POLICY, TECHNOLOGY AND THE STRUCUTRE OF AGRICULTURE

Tax laws and provisions are widely recognized as being a determinant of agricultural structure. There is not, however, agreement concerning the relative importance of tax policy because of interactions with other structural determinants. Some tax laws and provisions can be directly related to structure (i.e., estate and corporate tax law) while others (i.e., investment tax credits, depreciation provisions, capital gains, cash accounting) are indirectly related and often interact with credit, labor, and commodity policies.

There are a number of tax policy issues related to the structure of agriculture. Each of these issues is based on particular tax provisions or combinations of provisions which may have either intended or unintended impacts. Tax policy issus with implications for the structure of agriculture include:

- The role of tax law in nonfarm investment in agriculture.
- Tax provisions as a factor in economies of size.
- Tax law and the legal structure of agriculture.
- Tax policy and aggregate investment in agriculture.
- Tax shelter investments in agriculture.
- Tax laws and land prices.
- Tax policy and continuation of the family farm.
- Tax policy and equity, i.e., tax burdens for farm vs. nonfarm families.

Empirical studies in the areas listed above are limited. The studies which have been done tend to utilize budgeted examples and theoretical models rather than extensive empirical analyses. Data have been and will continue to be a serious problem. Even with data, separation of the effects of tax provisions

from other factors may be impossible. Investor motives are often an important consideration but will not be known to the researcher. The studies which have derived empirical estimates of the impacts of tax policy on farm firm decision making, investment behavior, and supply and prices of agricultural commodities typically do not relate these impacts to structure variables.

To take the analytical problems one step further, we should note that technology has not usually been an explicit part of research concerning the effects of taxes on agriculture. Neither, to my knowledge, have tax provisions been an explicit portion of research concerning the adoption of innovations. Thus, research addressing tax policy, technology and structural interrelationships is not readily available. This discussion, then, will be forced to deal with hypothetical interrelationships which may or may not be subject to empirical analysis.

Tax Policy and Technology

Tax policy may encourage, discourage or have no impact on the adoption of new technology. As a second step in the process, technology may or may not have structural impacts. There is also the possibility that tax policy will impact structure independent of technological considerations.

The adoption of new technology may be related to economic factors as well as risk considerations. Mansfield [1961] has shown that the rate of adoption for an innovation is related to expected profitability and the investment required. Risk reduction may also be a factor in the adoption decision. Tax provisions can influence both economic and risk factors. The report "A Time to Choose" discussed the process of structural change based on studies for three segments of the food system; the broiler, fed-cattle and processing-vegetable segments [p. 63]. Tax policy was not identified as a

factor in the adoption of technologies in the broiler and processing vegetable subsectors but it did play an important role in fed-cattle. Examples from the animals, plants and mechanical technological areas help to illustrate possible relationships between taxes, technology and structure.

Animal Technology

Cash accounting, current deductability of costs of raising livestock, and capital gains treatment for sales of breeding livestock together with investment tax credits and accelerated depreciation influence livestock investments and can impact structure in animal agriculture. Tax policy issues in animal agriculture include tax shelter and nonfarm investments, tax provisions as a factor in economies of size and the legal structure of agriculture. The fed-cattle sector can be used to illustrate possible structural impacts of efforts to exploit the favorable tax provisions applicable to agriculture.

The income tax advantages of cattle feeding were packaged as limited partnership syndicates in the late 1960's and early 1970's and sold to nonfarm investors. The growth of nonfarm investment in cattle feeding was closely associated with the movement of cattle feeding out of the Midwest and with the growth of large-scale feedlots in the High Plains area. Economic factors such as cheap feed, availability of feeder cattle, favorable climate and economies of size also played a role. Matthews and Rhodes concluded that tax induced investment in cattle feeding through limited partnerships was related to structural change. They stated that:

> "The limited partnership has contributed to the formation and growth of larger firms in the cattle feeding industry. Firms utilizing funds have been able to utilize more fully their existing feedlot capacity, to expand existing lots, and to acquire more lots until now the multi-lot cattle feeding firm is becoming common. Capacities of these "super firms" now reach and exceed 100,000 head.

> Much of this growth activity has occurred simultaneously with the adoption of the limited partnership by these firms. The limited partnership has been seized upon by these entrepreneurs as an opportunity to achieve rapid growth; the results have accentuated the shift in the location of the fed cattle industry from the farmer feedlots of the Midwest to the domain of the super firms with funds in the High Plains and Southwest. As the structure in the cattle feeding industry shifts from one made up of numerous small-to-medium-sized feedlots to one made up of fewer firms with much larger feedlot capacities, previously existing market relations begin to break down. Such related industries as slaughter and processing plants, grain suppliers, and trucking services are attracted towards the location of the larger firms [p. 26]."

There is limited research relating tax provisions to the adoption of large-scale production in other animal sectors but one can be confident that tax provisions have been and will continue to be an important factor. Cash accounting, accelerated depreciation, tax credits and capital gains treatment of income from breeding animals can increase cash flow substantially, an important factor in farm firm growth [Melichar, 1979; Tweeten, 1981]. Bryant et al. [1973] found that termination of cash accounting and capital gains treatment for breeding animals would significantly increase average annual income taxes for dairy farms. Income tax provisions have facilitated the growth of large-scale confinement dairy operations in California and have probably been a factor in the growth of dairies in other regions. Other factors associated with the growth of dairies include improved milking equipment, new milking parlor designs, improved productivity of the milking herd, and price support programs.

There is evidence that tax provisions were also a factor in the development of large-scale poultry operations. It is not widely known that egg production offers more tax shelter per dollar invested than does cattle feeding. In cattle feeding only the cost of feed is a tax deductible expense, but in egg production the cost of birds and feed are both deductible. Correspondence from an official of United Egg Producers several years ago

expressed concern over tax-motivated expansion. James Fleming, their Director of Public and Governmental Relations, stated that:

> "The Egg Industry has shown a great deal of concern over the issue of cash accounting to increase production facilities. We are considering asking Congress to modify tax laws to provide mandatory accrual accounting. Our efforts, however, are contingent upon some concessions being made to our industry which will entice our producers to support the necessary legislation."

We should note here that most of the increase in production facilities was being financed internally, not from nonfarm investment.

Pork producers have been adopting large-scale confinement production technology. The industry lobbied successfully to have the investment tax credit extended to single purpose structures. Now, with the investment tax credit and depreciation over five years with ACRS (Accelerated Cost Recovery System) there is concern about the possible supply response from new investment in confinement facilities. This tax law change can speed adoption of the capital intensive confinement production system which has been associated with recent structural changes.

Plant Technology

Lin et al. [1974] demonstrated that income tax provisions, particularly progressive tax rates, income averaging and loss carryovers, can have significant impacts on output and risk-taking behavior for risk adverse producers. Income tax provisions decrease the expected net farm income (E) and its variance (V) for various farm cropping systems. This may lead to investment in higher output and higher risk farming plans. Note that the movement to higher risk and income cropping systems involves moving from field crops to increasing proportions of "higher" risk crops such as fruit, nuts, grapes, and vegetables. One can hypothesize that these same tax rules reduce

the relative risks of adopting technological improvements in cropping systems, varieties, machinery, irrigation and other inputs.

Tax laws and changes in tax provisions can have dramatic and long-lasting impacts on perennial crops. A perennial crop supply response model was used to estimate the impact of development cost capitalization provisions for citrus and almonds on the development of these and other California orchard crops [Carman, 1981]. Estimated acreage and production of citrus and almonds decreased, as expected. The decreases in orange and lemon acreage, however, were more than offset by increased acreage of walnuts and grapes. The switch of developer and investor interest to walnuts and grapes appears to have added to the cyclical instability of production and prices for these two crops. The adjustments examined involved very significant time lags. The development of new perennial crop acreage often involves the adoption of new production technology such as disease resistent rootstocks, higher yielding varieties, denser plantings, orchards designed for machine harvesting, drip irrigation, or even new crops such as pistachios and kiwi fruit.

Studies of perennial crop supply response to changing tax rules have not related the impacts to structural variables. Given data availability and the many variables involved in structural change, it will be difficult to relate quantitatively acreage change to structure. It will be even more difficult to derive estimates of the interrelationships between tax policy, technology and structure.

Tax policy probably has little effect on the adoption of new technology in annual crop production. New varieties which offer advantages such as pest or disease resistance or higher yields will be adopted without regard to tax provisions since the costs of adoption are very low and the benefits are typically clear-cut.

Mechanical Technology

Current tax laws favor the substitution of capital for labor and undoubtedly speed the adoption of mechanical systems. Two tax factors are at work, payroll taxes which increase the cost of labor and the investment tax credit and accelerated depreciation which decrease the cost of machinery. In addition, mechanical harvest systems may reduce the risk of labor shortages at the critical harvest period and speed the adoption process.

Mechanical innovations can have important structural impacts but tax policy may play a very minor role in the adoption process. The adoption of the tomato harvester is a dramatic example of an innovation with significant structural implications for which tax rules were a minor consideration. The mechanical harvest system had clear cost advantages and growers were concerned about the availability of labor with termination of the Bracero Program. Now that adoption is complete, tax rules have an impact on replacement of harvesters which may cost $180,000 or more.

One would expect tax provisions to be an important consideration in the adoption of capital intensive innovations since the investment tax credit and accelerated depreciation do have a singificant impact on after-tax costs. Several innovations with possible structural impacts come to mind. These include the large four-wheel drive tractors, circle irrigation systems, minimum tillage systems, and larger scale and improved harvesters. Examination of economies of size studies for California farms shows that machinery and equipment investments are a very important source of technical economies of size. With machine capacity increasing through time, it is likely that the optimum or least-cost farm size has also increased. The role of tax provisions in the adoption of larger scale machinery and equipment through time has not been investigated.

Studies of Taxes and Structure

The changing structure of American Agriculture is a policy issue which has generated substantial interest, debate, and descriptive research over a long period. The mention of taxes as a structural determinant, however, is a rather recent development. With increasing average farm size and inflation, taxes and tax planning have become an important consideration in managing the farm firm.

Dean and Carter [1962] published one of the early studies on the impact of income taxes on cost-size relationships in agriculture. They concluded that a progressive income tax reduces the optimal level of output when tax deductible costs are less than economic costs. They also posed hypotheses concerning the impact of income taxes on the availability of risk capital for agriculture and on land values. Using their analytical framework, one can demonstrate that decreasing marginal tax rates increases optimum farm size. Harl, however, argued that "it appears on balance that the legal and tax structure does not discriminate systematically against small-scale and for large-scale firms [1969, p. 1391]." Neither of these studies examined possible interrelationships between tax provisions and technological change.

Several studies of structure and structural change in agriculture have been published since 1980. Included are major studies by the U.S. Department of Agriculture and the U.S. Senate Committee on Agriculture. These studies examine factors affecting structure, describe the structure for selected commodity sectors, and project future structure. A short discussion of selected studies in terms of interrelationships between tax policy, technology and structure follows.

U.S. Senate Committee on Agriculture

The U.S. Senate Committee on Agriculture published a report "Farm Structure: A Historical Perspective on Changes in the Number and Size of Farms" [1980] to lay the groundwork for development of the 1981 farm bill. Their report includes 24 separate papers with 15 describing structural change for individual commodities. Each of the commodity papers describes factors associated with structural change for that commodity but none estimates in quantitative terms the relative impact of the various structural determinants mentioned. The study of changing structure of the diary industry, for example, concluded that technological changes in milk production have been at the foundation of the changing structure of dairy farming [p. 155]. Taxes and tax policy together with financing were also mentioned as significant factors affecting structure [p. 156]. This study and others in the report, however, generally did not consider interrelationships between tax policy and technology.

A Time to Choose

The U.S. Department of Agriculture report "A Time to Choose: Summary Report on the Structure of Agriculture" [1981] summarizes Secretary of Agriculture Bergland's Structure of Agriculture Project. This report contains a chapter on tax policies related to structure and discusses consequences of tax policy. The discussion of the impacts of tax policy is in terms of the direction of impacts; no precise estimates of the impact of tax policy or other structural determinants are available. The report concludes that federal tax policies impact on the structure of agriculture in several important ways. The major impacts were summarized as:

> "Higher land prices, reduced land sales, and increased concentration of land ownership, all of which contribute to increased tenant

> farming and to concentration of wealth (land) in the hands of those who did not earn it.
>
> Strong incentives for larger farm operations to grow, substitute capital for labor, and use debt heavily--all contributing to concentration in farm ownership and production and to more capital-intensive technology.
>
> Artifical incentives to high-income taxpayers to invest in certain farming activities solely to be able to shift income taxable at current income rates into capital gains taxable at lower rates. This distorts the use of land and other resources and thus probably reduces overall economic efficiency in the farm sector [p. 98]."

The discussion does not consider the interrelationships between taxes and other structural determinants such as technology and, as noted above, does not document the relative impact of tax policies on structure. Neither does the report by Davenport, Boehlje and Martin [1982], upon which much of the summary report concerning tax policy was based.

Specialized Studies

There were a number of special studies done as part of the Structure of Agriculture Project. Two, which were reviewed in preparing this paper, are indicative of the present state of knowledge of interrelationships betwen structural determinants.

Reimund, Martin and Moore [1981] examined structural change for broilers, fed cattle and processing vegetables to determine why and how structural changes take place in agriculture. They found that structural change occurs in four stages, with the first stage being the adoption of new technology to exploit new or changed external factors. The adoption of technology may be in response to new technology, changing markets and demand, or new Government policies and programs. They use the three sectors examined to develop a general model of structural change but make no attempt to determine the relative importance of structural determinants in the changes described.

Lin, Coffman and Penn [1980] projected the number and size distribution of farms to the year 2000. They project a decrease in farm numbers from 2.9 million in 1974 to 1.8 million in 2000, with large farms dominating agricultural production. Their projections were based on four analytical methods: trend extrapolation, negative exponential functions, Markov process and age cohort analysis. Since each of the methods utilized are trend related, they assume no significant changes in underlying conditions. Thus, the study does not incorporate structural determinates nor interrelationships between these determinates.

Taxes, Technology and Structure--Gaps in Knowledge

Based on the above short discussion, one can conclude that the gaps in knowledge concerning impacts and interrelationships between taxes and technology in determining agricultural structure are large. Previous studies acknowledge that technology and tax policy can each have important structural impacts but quantitative estimates of their separate effects, interactions or the impacts of other structural determinants are not available.

We have a complicated set of tax laws and provisions in place. One can only speculate on how this total policy relates to present technology and agricultural structure. Changes in tax laws, however, do have impacts which can be analyzed given proper data. These impacts may be difficult to relate to structural variables and may or may not be related to technological change. A study of the impact of cost capitalization provisions for citrus and almonds effective in 1970 and 1971, for example, resulted in estimates of the impact on California acreage, production and product prices for these and competing crops [Carman, 1981]. Converting these estimates into quantitative estimates of structural impacts is difficult and the results may depend as much on one's

assumptions regarding the actions of participants as on the changes in acreage, production and prices.

A comment in "A Time to Choose" summarizes the situation:

> "Tax policies have had some influence on the structure of agriculture. How much influence they have had--compared to such other factors as interest rates, crop prices, weather, technological change, and subsidy programs--is uncertain.
>
> Some observers believe that the force of tax policy has been strong. Others think it has largely reinforced the directions in which other factors were propelling agriculture. . . . precise estimates of the intensity of its effects are simply not available [p. 92]."

Research Approaches

There is little empirical evidence concerning the relationships between tax policy and technology and on resulting impacts on agricultural structure. Thus, research examining basic relationships between tax policy and the adoption of technology will be useful. Quantitative estimates of the relationships between changing tax policy and structure as well as technology and structure is also needed. Causal relationships can be very useful components in future projections of agricultural structure and in the examination of changes in structural determinants. Since the combination of changing technology and tax policy tends to be commodity specific, research will necessarily take the form of case studies.

Davenport, Boehlje and Martin note that ERS has developed generalized computer simulation models to do estate and business tax computations and is considering adding a model to do income tax computations. They suggest interfacing these tax calculators with the illustrative farms work being done by ERS to provide an up-to-date data base [p. 56]. These proposals would provide information on the impact of tax law changes on agricultural

operations but, in the present form, would have little information on changes in technology or changes in structure.

More general structural change models will be required to assess the probable impacts of changes in technology and tax laws on structure. Although difficult to estimate, they will need to incorporate causal relationships as explanatory variables rather than relying on trend extrapolations. As noted above, the models will probably be commodity and regional specific.

REFERENCES

yant, William R., Eddy L. LaDue and Robert S. Smith. Tax Reform and Its Effect on the Dairy Farmer. Dept. of Agr. Econ., Cornell Univ., May 1973.

man, Hoy F. "Income Tax Reform and California Orchard Development." Western J. Agr. Econ. 6(1981):165-80.

enport, Charles, Michael D. Boehlje, and David B.H. Martin. The Effects of Tax Policy on American Agriculture. Washington, D.C.: U.S. Dept. of Agr., ERS Agr. Econ. Rep. No. 480, Feb. 1982.

n, Gerald W. and Harold O. Carter. "Some Effects of Income Taxes on Large-Scale Agriculture." J. of Farm Econ. 44(1962):754-68.

ning, James F. Director of Public and Governmental Relations, United Egg Producers, Atlanta, Georgia. Personal Correspondence, May 1, 1972.

, Neil E. "Do Legal and Tax Rules Favor Large-Scale Agricultural Firms?" Am. J. Agr. Econ. 51(1969):1381-92.

William, H. F. Carman, C. V. Moore, and G. W. Dean. "Producer Response to Income Taxes: An Empirical Test Within a Risk Framework." Nat. Tax J. 27(1974)183-95.

William, George Coffman, and J. B. Penn. U.S. Farm Numbers, Sizes, and Related Structural Dimensions: Projections to Year 2000. Washington, D.C.: U.S. Dept. of Agr. ESCS Tech. Bul. No. 1625, July 1980.

field, Edwin. "Technical Change and the Rate of Imitation." Econometrica 29(1961):741-66.

ews, Stephen F. and V. James Rhodes. In The Use of Public Limited Partnership Financing in Agriculture for Income Tax Shelter. North Central Regional Project No. 117, Monograph No. 1, July 1975, pp. 1-3.

Melichar, Emanuel. "Capital Gains Versus Current Income in the Farming Sector." Am. J. Agr. Econ. 61(1979):1085-92.

Reimund, Donn A., J. Rod Martin, and Charles V. Moore. Structural Change in Agriculture: The Experience for Broilers, Fed Cattle, and Processing Vegetables. Washington, D.C.: U.S. Dept. of Agr. ESS Tech. Bul. No. 1648, April 1981.

Tweeten, Luther. Farmland Pricing and Cash Flow in an Inflationary Economy. Oklahoma State Univ. Research Rep. P-8111, 1981.

U.S Department of Agriculture. A Time to Choose: Summary Report on the Structure of Agriculture. Washington, D.C., Jan. 1981.

U.S. Senate Committee on Agriculture. Farm Structure: A Historical Perspective on Changes in the Number and Size of Farms. Washington, D.C.: 96th Congress, 2nd Session, April 1980.

Background Paper No. 3

Overview of Capital and Credit Markets Serving Agriculture: Their Impact on Technology Adoption and Structural Change

David A. Lins
University of Illinois

March 1985

Office of Technology Assessment
U.S. Congress

This background paper was prepared for the assessment "Technology, Public Policy, and the Changing Structure of American Agriculture." The views expressed are those of the author(s) and not necessarily those of OTA.

OVERVIEW OF CAPITAL AND CREDIT MARKETS SERVING AGRICULTURE: THEIR IMPACT ON TECHNOLOGY ADOPTION AND STRUCTURAL CHANGE

David A. Lins

I. INTRODUCTION

New technologies often require large amounts of capital, both for development and adoption. While financing the development of new technologies is clearly important, the focus here is on financing the adoption of new technologies. The adoption of new technologies may be enhanced or slowed by both the availability of capital and the perceived profitability of new technologies. Readily available capital at reasonable rates and terms plus profitable technologies, provides a favorable environment for technology adoption, while shortages of capital may impede the adoption process. The purpose of this paper is to review the capital and credit markets and institutions that serve agriculture and to assess their impact on the adoption of emerging agricultural technologies.

This paper is divided into six major sections. Section I provides a brief introduction, while Section II focuses on the relative importance of debt and equity capital in U.S. agriculture and the relationships among capital, technological adoption and structural change. Section III summarizes the impacts of monetary and fiscal policies on capital availability, structural change and technology adoption. A more in-depth look at debt and equity capital sources in U.S. agriculture is provided in Section IV and V respectively. Section VI summarizes the major conclusions of the paper.

II. CAPITAL SOURCES FOR AGRICULTURE

It is useful to separate capital used in agriculture into two broad categories -- debt capital and equity capital. Debt capital is defined as funds which are borrowed and must be repaid with interest. Payments of principal and interest represent claims on the business which have priority over the withdrawal of net income by the owners of the business. In contrast, equity capital represents an ownership interest in the business. Net income and capital gains reflect the returns to equity capital.

Relative Importance of Debt and Equity Capital In Agriculture

The relative importance of debt versus equity capital in the farm production sector can be examined using either a "stock of capital" or "flow of capital" concept. The stock of capital in agriculture is revealed by the Balance Sheet for the Farming Sector (Table 1.1). As shown in Table 1.1, approximately 20 percent of the total capital used in agriculture is in the form of debt capital. Debt capital as a percent of total capital in agriculture increased from about 10 percent in 1950 to 20.7 percent by 1985. As the proportion of debt capital in agriculture increases, the adoption of new technologies becomes more of a joint decision between farm operators and the lenders who provide debt capital. To the extent that new technologies require the use of borrowed funds for adoption, lenders may play a key role in the adoption process. Lenders as well as farm operators must be convinced of the value of new, and perhaps untested, technologies. Educational efforts to acquaint lenders with new technologies will become increasingly important if such technologies are to be financed with debt capital.

Equity capital accounts for the majority of funds used in agriculture. Equity capital may come from a variety of sources, including initial

Table 1.1. Balance Sheet of the Farming Sector, January 1, 1985[a]

Item	1985[b] Billion dollars
Assets	
Physical Assets:	
Real estate	749.2
Nonreal estate:	
Livestock and poultry	50.4
Machinery and motor vehicles	106.5
Crops stored on and off-farm	38.2
Household equipment and furnishings	26.0
Financial assets:	
Deposits and currency	18.7
Savings bonds	3.7
Investments in co-ops	29.7
Total assets	1,022.4
Claims	
Liabilities:	
Real estate debt	110.9
Nonreal estate debt to:	
CCC	8.3
Others	93.0
Total liabilities	212.1
Proprietors' equity	810.7
Total claims	1,022.4
Debt to asset ratio	20.7

[a]Source: Agricultural Finance: Situation and Outlook, AFO-25, ERS-USDA, December, 1984.
[b]Preliminary.

investment and retained earnings of farm owners and operators. Importantly, much of the equity capital in agriculture is the result of asset appreciation. Equity capital is also provided by investors who are not farmers, but who have an ownership interest through shares of stock, partnership interests or other forms of equity investment.

Much of the equity capital in agriculture is invested in farm real estate. A significant portion of this equity capital, some 42 percent nationwide, is rented, but substantial regional variation exists. In addition to real estate, there appears to be a growing amount of machinery and equipment which is leased to take advantage of tax regulations. Overall, the significant amount of leasing of agriculture assets suggests that a considerable amount of equity capital in agriculture is controlled by individuals or institutions who may not be actively engaged in farming operations.

The relative importance of debt versus equity capital can also be viewed in the context of the flows of capital. Aggregated cash flow statements prepared by the U.S. Department of Agriculture show that the net flow of loans relative to total cash sources of funds increased from 1973 to 1979, but has generally fallen since that time (Table 1.2). Likewise, the net flow of loans as a percent of total purchased capital varies widely from year to year but has fallen sharply in recent years. The numbers reveal that borrowed funds as a percent of total cash sources or as a percent of total capital purchases tends to increase in good income years and decrease when incomes fall. Hence, if technological advances occur in years of low income, those technologies are much more likely to be financed with equity capital than debt capital.

Table 1.2 Total Net Flow of Loans as a Percent of Total Cash Sources of Funds and Total Purchased Capital, 1973-1984. [a]

Year	Net Flow of Loans as a Percent of Total Cash Sources of Funds	Net Flow of Loans as a Percent of Total Purchased Capital
	---percent---	
1973	12.5	37.5
1974	11.4	40.8
1975	14.6	39.4
1976	16.2	41.1
1977	21.2	51.0
1978	18.0	42.0
1979	25.3	69.1
1980	16.6	43.3
1981	17.2	50.2
1982	8.2	22.6
1983	4.1	12.3
1984[b]	-5.0	-14.3

[a] Source: Agricultural Finance Outlook, USDA various issues.

[b] Preliminary

Relationships Among Capital Availability, Technological Adoption and Structural Change

The structure of U.S. agriculture is usually defined in the context of the number and size of farms, tenure patterns, forms of business organization, and the degree of contract production and vertical integration. Many factors have combined to cause changes over time in farm structure. The relationships among availability of capital, new technologies, and structural change are reviewed below.

The number of farms in the U.S. has declined substantially since 1935 and average farm size has nearly tripled. While some credit programs of the Farmers Homw Administration may impede a move to larger farms by maintaining smaller farms, other credit programs have facilitated a move to fewer and larger farms. Overall, the number of farms would probably not have decreased as rapidly had credit for the purchase of land been less readily available.

The availability of both capital and new technology also played a major role in the move toward fewer and larger farms. Developments in machinery and buildings allowed for much larger production units without a corresponding increase in labor requirements. Readily available credit facilitated adoption of capital-intensive production methods, thus abetting a shift to fewer and larger farms. For example, Southern cotton farmers (who formerly used large amounts of hand labor) adopted new technologies to shift to fewer and larger farms without increasing labor costs. New technologies also created significant financial gains for early adopters thereby fostering an environment in which the more efficient farmers could successfully buy out the less efficient farmers.

Tenure patterns have also changed dramatically in U.S. agriculture. Over time there has been a rapid rise in the percentage of operators who are either

full or part owners and a corresponding decline in the percentage of farms operated by full tenants. The easing of terms on farm real estate loans likely encouraged this shift. Technological change, especially in machinery, has created an environment in which farm operators have the capacity to farm much more land than they have the capital to control through ownership. As a result, the proportion of part-owners has increased.

The form of business organization (sole proprietorship, partnership, or corporation) is another component of farm structure. Past research, however, has shown that the form of business organization is seldom influenced by the availability of credit or technological breakthroughs. Rather this aspect of farm structure appears to be affected most strongly by tax laws.

Contract production and vertical integration are the process of linking two or more stages of production under the control of one firm. Some types of agriculture, broiler production and large segments of fruit and vegetable production, have moved in this direction. At issue is whether or not such actions were taken as a result of technological changes or credit availability. Past research suggests the inducement for this type of action is probably much more closely associated with the need to control the quantity and quality of production than with the effects on the availability of credit or the adoption of new technologies.

The above discussion suggests that credit availability and technological change have interacted to facilitate a change in some, but not all, of the structural components of agriculture. However, cause and effect are hard to establish. One might characterize the relationship between credit availability, technological change, and structure as being simultaneously determined. Under this characterization, technological change and credit availabililty are affected by and affect the structure of agriculture.

III. MONETARY AND FISCAL POLICY IMPACTS

The adoption of new technology and structural change in agriculture does ot take place in a vacuum free of influence from outside the sector. Rather, e agricultural sector is closely linked to national and international onomies. Public sector policies and programs have a major influence on the onomies of the world and this in turn has an influence on technology adoption d structural change in agriculture. The potential influences of monetary and scal policies on agriculture are identified in the following sections

netary Policy

The amount of money and credit in the economy, and their rate of change, e the primary concerns of monetary policy. The Federal Reserve System is the imary regulatory authority which determines the direction of monetary policy the United States. The objectives of the Federal Reserve System are to omote domestic economic growth, avoid excessive inflationary or recessionary essures, maintain a sound U.S. balance of payments, and promote full ployment. The simultaneous achievement of these goals is extremely difficult d the Federal Reserve is often faced with selecting which policy objective s highest priority.

The Federal Reserve System influences the amount of money and credit in e economy through a variety of instruments. Discussion of these instruments beyond the scope of this paper. However, the Federal Reserve does use dicators to determine their success in controlling the amount of money and edit in the economy. The two most commonly used indicators are (1) interest tes, and (2) the rate of growth in the money supply.

For many years the Federal Reserve used the level of interest rates as a y indicator of the success of monetary policy. Nominal interest rates were

controlled within a fairly narrow range. However, during the 1970's the inflation rate began to rise while interest rates were controlled by Federal Reserve actions. The net effect was a fall in real interest rates. Figure 1.1 identifies the estimated real interest rate on 3-month Treasury bills from 1962 through 1984.

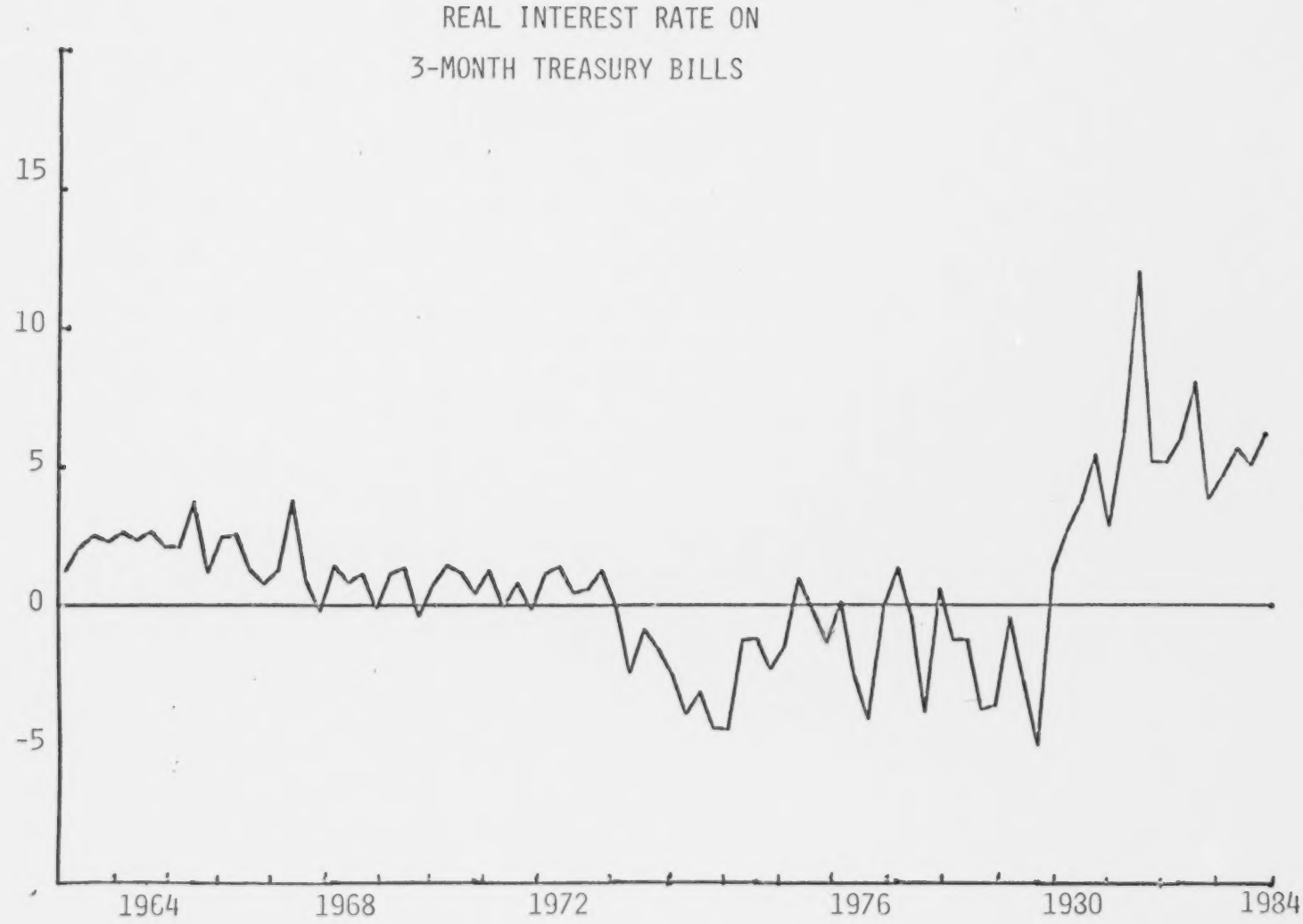
From 1962 through 1972 the real interest rate was generally positive in the range of 1 to 2 percentage points. From 1972 through 1979, real interest rates were usually negative, suggesting that investors in Treasury bills lost money in real terms. Federal Reserve actions to control interest rates in the face of rising inflation were primarily responsible for this outcome.

Recognizing that savings are strongly discouraged by negative real interest rates, the Federal Reserve System in 1979 shifted from a policy of controlling interest rates to a policy of controlling the rate of growth in the money supply. The result was a rapid increase in the real interest rate as well as increased variability in nominal interest rates.

Since 1983, the real interest rate on 3-month Treasury Bills has generally been in the range of a positive 5 to 7 percent. The level of real interest rates is likely a major determinant of investment in agricultural assets, particularly for nonfarm investors. With high real interest rates there is less incentive to borrow money to invest in new technologies. Consequently, actions taken in the pursuit of monetary policies have a major impact on the agricultural sector.

The strength of the U.S. dollar also has a major impact on the agricultural sector. The level of interest rates in the U.S. compared to those in other countries is a major determinant of the strength of the dollar. Since monetary policies have a direct influence on the level of interest rates, they also have a direct impact on the strength of the dollar. In 1984, the U.S.

Figure 1.1


REAL INTEREST RATE ON
3-MONTH TREASURY BILLS
15
10
5
0
-5
1964
1968
1972
1976
1930
1984

dollar reached a 12 year high against many major foreign currencies. A strong dollar decreases the level of agricultural exports thereby reducing incomes of producers of export dependent products. While the incomes of other producers may actually increase, the overall level of income for the sector is expected to decline. As income of agricultural producers decline, there is less capital available for investment in new technologies. Likewise, in a period of falling incomes, credit may be used more to overcome shortfalls in income rather than to finance new investments or transfer resources.

Much of the emerging agricultural technology appears to be of the form which would require expenditures on operating inputs such as genetically enhanced seeds, chemicals, embryo transplants and other products normally financed with the farm operators capital or short-term credit. While the decisions on the purchase of these inputs is affected by the level and variability of interest rates (which in turn is influenced by monetary policy) it seems more likely that the decisions to adopt these new technologies will be more strongly influenced by the expected returns from adoption. Some technologies may be so profitable to adopt, at least in the short-run, that the level of interest rates has little impact on the decision process.

Fiscal Policy

Fiscal policy involves the taxation and spending policies of the Federal government. The objectives of fiscal policy are to carry on the functions of government, promote economic growth and full employment, and maintain price stability. Fiscal policy instruments used to achieve these objectives include both automatic and discretionary taxation and spending alternatives.

Automatic taxation instruments include the progressive income tax structure which raises taxes as incomes increase and decreases taxes when

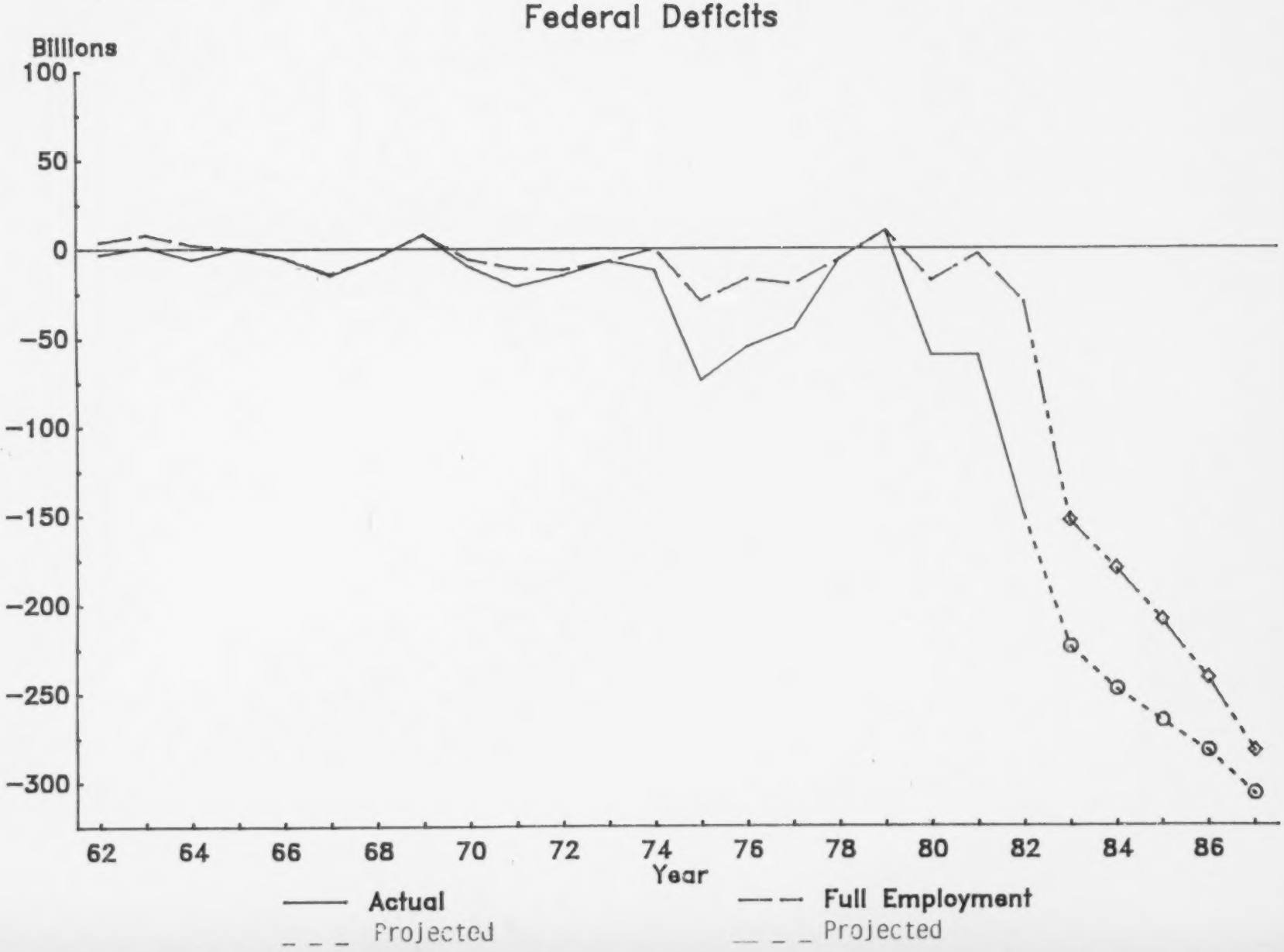
incomes fall even if Congress has made no explicit changes in tax rates. Automatic spending instruments include unemployment compensation which automatically changes government expenditures when unemployment changes.

Descretionary items include those taxation and spending patterns which require specific Congressional action to change. In the area of taxation for example, depreciation rates and investment credit change only as the result of legislative changes. Likewise, numerous spending programs require legislative action before the level of expenditure is changed. A major problem in meeting the objectives of fiscal policy is that much of government spending falls into the category of "entitlements" leaving little that legislators can do to change the total level of government expenditures.

Federal budget deficits, the excess of government spending over tax revenues, are frequently cited as a major determinant of interest rates. Some argue that large budget deficits create such a strong demand for credit that government borrowing will "crowd out" the demands of the private sector for credit if the deficit is not funded by expanding the money supply. Others suggest that budget deficits occur primarily as a result of high unemployment and recessions which reduce tax revenues and create more expenditures on income transfer programs. If true, this latter view suggests that Federal deficits have little impact on interest rates. In fact, statistical studies show a very low correlation between budget deficits and the level of interest rates.

To gain a better perspective on these opposing arguments, it is useful to review the nature of government deficits. Figure 1.2 shows the historical pattern of Federal deficits. The level of the deficit has increased substantially over time. But a more relevant concept is to identify how much of a deficit would have existed if the economy had been at full employment. Notice that the full employment deficit was actually decreasing from 1975 through 1981. However, by 1982 the full employment deficit had reached $30

Figure 1.2


Federal Deficits
Billions
100
50
0
−50
−100
−150
−200
−250
−300
62
64
66
68
70
72
74
76
78
80
82
84
86
Year
Actual
Projected
Full Employment
Projected

billion dollars while the actual budget deficit was nearly $150 billion. Projections estimates for 1983 through 1987 show huge full employment deficits. It seems likely that full employment deficits have contributed to the level and variability of interest rates.

To the extent that fiscal policies affect the level and variability of interest rates, they also affect credit availability and the adoption of new technologies in agriculture. Again, the impact on the adoption of new technologies may depend upon whether or not the new technologies are capital intensive. Fiscal policies which result in large budget deficits will have a much more deliterious effect on capital intensive technologies than on technologies which require little capital investment but reduce costs of production.

IV. DEBT CAPITAL SOURCES FOR AGRICULTURE

American agricultural producers borrow from a wide variety of lending sources. The financial institutions that serve agriculture are in a constant state of change, due in part to changes in the regulatory environment under which they operate. Indeed, recent changes in the regulatory environment have altered the nature and operating characteristics of these financial institutions; savings and loan associations, as well as Sears, American Express, and other nontraditional sources, are more likely now than in the past to provide financial services to farmers. Understanding the financial institutions serving agriculture, and the changes occurring in these institutions, can help one better understand how credit availability may impact on technological adoption and structural change.

Farm Credit System

The Farm Credit System is a cooperative that is owned and controlled by member borrowers. The System began in 1916, when the Federal Land Banks were established to help farmers and ranchers gain access to long-term farm loans under more favorable rates and terms that were available from other sources. In 1923, the Federal Intermediate Credit Banks were formed to provide discounting services for short and intermediate term loans. Production Credit Associations and the Banks for Cooperataives were started in 1933. The cooperative nature of this System is the central focus of its organization and operation.

Originally, the System was partially capitalized by the federal government; however, all government capital has since been repaid. Although the System is directed by the borrowers and their elected representatives, it is supervised by the Farm Credit Administration, an independent agency in the executive branch of the federal government.

Unlike most other private lenders serving the farm sector, the Farm Credit System has a limited purpose charter. That is, the System is restricted to making loans only to farmers, fishermen, agricultural cooperatives and rural residents who meet eligibility standards set by law. Commercial banks and life insurance companies, in contrast, face no such restrictions.

The Farm Credit System acquires funds to lend through the sale of bonds and discount notes in the national money market. The System has "agency status" in selling its bonds and discount notes. Agency status has been shown to reduce the cost of issuing bonds. In recent years, agency status for the Farm Credit System has come under attack as an unfair competitive advantage. If agency status were removed, the cost of issuing bonds would likely increase

by 50 to 100 basis points thereby reducing the quantity of credit demanded to finance new technologies or ownership transfers.

Starting in 1969, the Farm Credit System began charging variable interest rates on farm loans. Today, virtually all loans are on a variable rate. As a result, interest rate risks have been passed on to borrowers. Despite charging variable rates, the System has achieved a fairly stable pattern of rates. Yet some farmers did experience interest rate increases so high that anticipated profitability was not achieved. In recent years some parts of the System have begun to offer fixed rate financing alternatives through financial leasing of machinery and 5-year fixed rate loans on real estate. Such fixed rate alternatives may help risk averse farmers finance the purchase of new technologies that may not have been made under variable rate loans.

At present, there appears to be a move within the System to consolidate administrative units and to offer a broader range of financial services to farmers. These actions may have little direct impact on credit availability or the adoption of new technologies. However, it may make the System more efficient and cost effective thereby reducing the cost of credit. Such a reduction in cost would likely provide some small impetus to technology adoption.

Commercial Banks

Commercial banks are a major source of both real estate and non-real estate loan funds for agriculture. Historically, they have been the largest institutional source of non-real estate farm loans. While not all commercial banks are actively involved in making long-term farm mortgage loans, most do provide referral services that help farm operators obtain farm mortgage funds from other lenders.

Commercial banks vary in size, from the very small rural banks with few deposits and loans, to the very large banks like Bank of America, which has numerous branches and a huge deposit base. In general, most of the loans to farmers and ranchers made by commercial banks come from small and intermediate size banks serving a relatively small geographic area. While large banks also lend directly, they serve agriculture through correspondent services with smaller rural banks and via loans to agribusiness firms.

Commercial banks in the United States can be chartered under either state or federal law. However, each state regulates the extent to which both state- and nationally-chartered banks can branch within a state. The alternatives include (1) unit banking, (2) limited branching, and (3) statewide branching. Twenty-three states now allow statewide branching, 16 allow limited branching, while eleven are unit branching banking states. Some states also allow multi-bank holding companies while others do not.

Commercial bank sources of loanable funds tend to be more diverse than those available to Farm Credit System. Deposits are the major source of funds for commercial banks. Although deposits were a relatively inexpensive source of funds in the past, financial deregulation has significantly increased the rates paid on deposits.

Commercial banks face legal limits on the amount they can lend to any one individual or entity. Many small rural banks have legal lending limits that are less than the size of loan requests from their largest customers. When this occurs, the banks can attempt to get a correspondent bank to take the overline portion of the loan. However, correspondent relationships on overline loans have not always worked to the satisfacation of the smaller bank. As a result, some banks have failed to serve large customers, thereby causing these borrowers to seek loans from other institutions.

A fundamental change in the structure of commercial banks appears to be taking place. Many small and intermediate size banks are being acquired by larger banks or bank holding companies. As a result, the number of banks is expected to decline, and average size to increase in the future. It remains to be seen how this may affect credit availability, technological adoption or structural changes in agriculture. However, one change appears to be a growing aggressiveness on the part of banks to seek farm real estate loans. This suggests that larger banking units may more aggressively seek new lending opportunities. However, metropolitan banks that acquire smaller rural banks may be reluctant to finance new technologies if they are not familiar with agricultural lending. As banks become larger, it may result in increased use of specialist in agricultural lending. It may also move the decision making process from the local scene to a more metropolitan center. Thus, lender education on new technologies may become more important than in the past.

Insurance Companies

Several of the major life insurance companies have been actively engaged in farm mortgage lending for many years. Five companies (Equitable, John Hancock, Prudential, Travelers, and Metropolitan) have acccounted for over 75 percent of the total farm mortgage lending by insurance companies. Insurance companies have tended to focus on real estate loans for larger farms. Since these farmers may be early adopters of new technology, insurance companies may have had a role in the adoption of land intensive technologies which is much larger than their market share of farm debt. However, the market share of insurance companies as a whole has diminished over time.

Insurance companies offer a variety of loan terms and financing plans. Fixed rate loans with a relatively long amortization period, but with balloon payments after 10 or 20 years, were common in the past. However, the inflationary environment of the late 1970s and early 1980s caused insurance companies to substantially shorten the period before which interest rates could be renegotiated.

Some insurance companies have also experimented with shared appreciation mortgages (SAMs). A SAM works in the following manner. In exchange for a fixed interest rate at below market rates, the lender shares in a designated portion of capital gains. At the end of a designated period, normally 5 or 10 years, the land is either sold or reappraised with the lender's share of the gain due. The amount due the lender can be handled either as a lump sum payment, or, more likely, as an increase in the loan balance.

The insurance industry has undergone substantial changes in its sources of funds and in the products and services that it offers to agriculture. Equity participations appear likely to flourish in the future, either in the form of direct investment or in the form of shared appreciation mortgages. Thus insurance companies may become more actively engaged in equity financing as opposed to debt financing.

Government Lending Agencies

The federal government provides loan funds to agriculture primarily through the Farmers Home Administration (FmHA) and the Commodity Credit Corporation (CCC). The Small Business Administration (SBA) also made agricultural loans during the late 1970s, but have since discontinued lending to farm firms. The FmHA offers a variety of loan programs including farm ownership and operating loans. To be eligible for these loans, farm

operators must demonstrate that they are unable to obtain adequate loan funds on reasonable terms from other lenders. As a result, FmHA is usually considered a lender of last resort.

The FmHA offers two types of loans: insured and guaranteed. Insured loans are made and serviced by FmHA personnel, and represent about 80 to 90 percent of FmHA's total loan volume. Guaranteed loans are made and serviced by other lenders, but are guaranteed against default by the FmHA.

Congress controls the extent of FmHA lending programs in two major ways: appropriations and lending authorization. Appropriations are needed to cover losses and administrative expenses. By controlling the level of appropriations, Congress also controls the extent to which administrative expenses and loan losses can be incurred.

Lending authorizations specify the maximum amount that FmHA can lend out under various programs. These lending authorizations are set annually and are designed to control the nature of the programs offered. For example, if Congress wishes to encourage guaranteed loan programs over insured programs, Congress can raise the lending authorizations for guaranteed loans while reducing the authorization for insured loans.

FmHA farm loan programs have focused on farm operators with limited resources and those affected by disaster. The impact of these programs has likely been to slow the concentration of resource ownership and control in large farms by keeping smaller farms in agriculture. It is less clear what impact, if any, FmHA programs have had on technological adoption. However, to the extent that adoption of new technologies are based upon the ability of farm operators to control larger units (for example, 4-wheel drive tractors), FmHA loan programs may have slowed the rate of adoption by preventing additional land from coming on the market.

The Commodity Credit Corporation (CCC) is a part of the United States Department of Agriculture that provides financial assistance to farm oprators through four channels: (1) deficiency payments, (2) disaster payments (although these have essentially been replaced by multiple peril crop insurance), (3) crop loans, and (4) storage facility loans. The programs offered by CCC are a part of government farm programs designed to improve and/or stabilize the incomes of agricultural producers.

CCC loan programs and the associated farm commodity programs have likely had a significant influence on the structure of U.S. agriculture. The stabilization and improvement of incomes generated by such programs have likely reduced risks and encouraged the adoption of new technologies.

Merchants and Dealers

The term "merchants and dealers" refers to farm suppliers of feed, seed, chemicals, fertilizer, petroleum, machinery, and equipment. These firms are an important source of nonreal estate loan funds for agriculture. For operating inputs, such credit often takes the form of accounts payable. For capital inputs, credit may be extended for a 3-5 year period.

Dealer credit is often viewed as a method of promoting sales. To some degree, merchant-dealer credit programs have helped foster the adoption of new technologies This is particularly true for new technologies associated with high cost capital items. Dealer credit programs would appear to have less impact on the adoption of new technologies associated with operating inputs.

Market Shares of Farm Debt

The market share of farm debt refers to the percentage of the total volume of lending by a particular lender. It is useful to distinguish market shares of real estate debt from market shares of non-real estate farm debt.

Trends in the market share of farm real estate debts are shown in Figure 1.3. The market share of farm real estate debt held by Federal Land Banks has increased dramatically over time. In contrast, the market shares for individuals, life insurance companies, and commercial banks have all followed a downward trend, while the market share of farm real estate debt for the Farmers Home Administration has remained fairly constant over time. By 1978, the Federal Land Banks became the dominant source of farm real estate loans, surpassing those provided by individuals.

The growing dominance of the Federal Land Bank System has implications for the future structure of agriculture. Policies adopted by the System will tend to dictate how transfers of land ownership will be financed. However, the changing market shares of farm real estate debt would appear to have little direct impact on the adoption of new technologies.

Market shares of non-real estate farm debt are illustrated in Figure 1.4. The most notable features of this graph are the rather sharp decline in market share for commercial banks and the increase in market share for the Commodity Credit Corporation (CCC) and the Farmers Home Administration (FmHA). Market shares for PCAs and others (primarily merchants and dealers) have remained fairly constant over time.

The increase in market shares for government lending institutions (FmHA and CCC) reflects the expansion of government programs to support agricultural prices and to deal with economic and natural disasters. The decline in market shares of commercial banks resulted from many factors including the problems

Figure 1.3

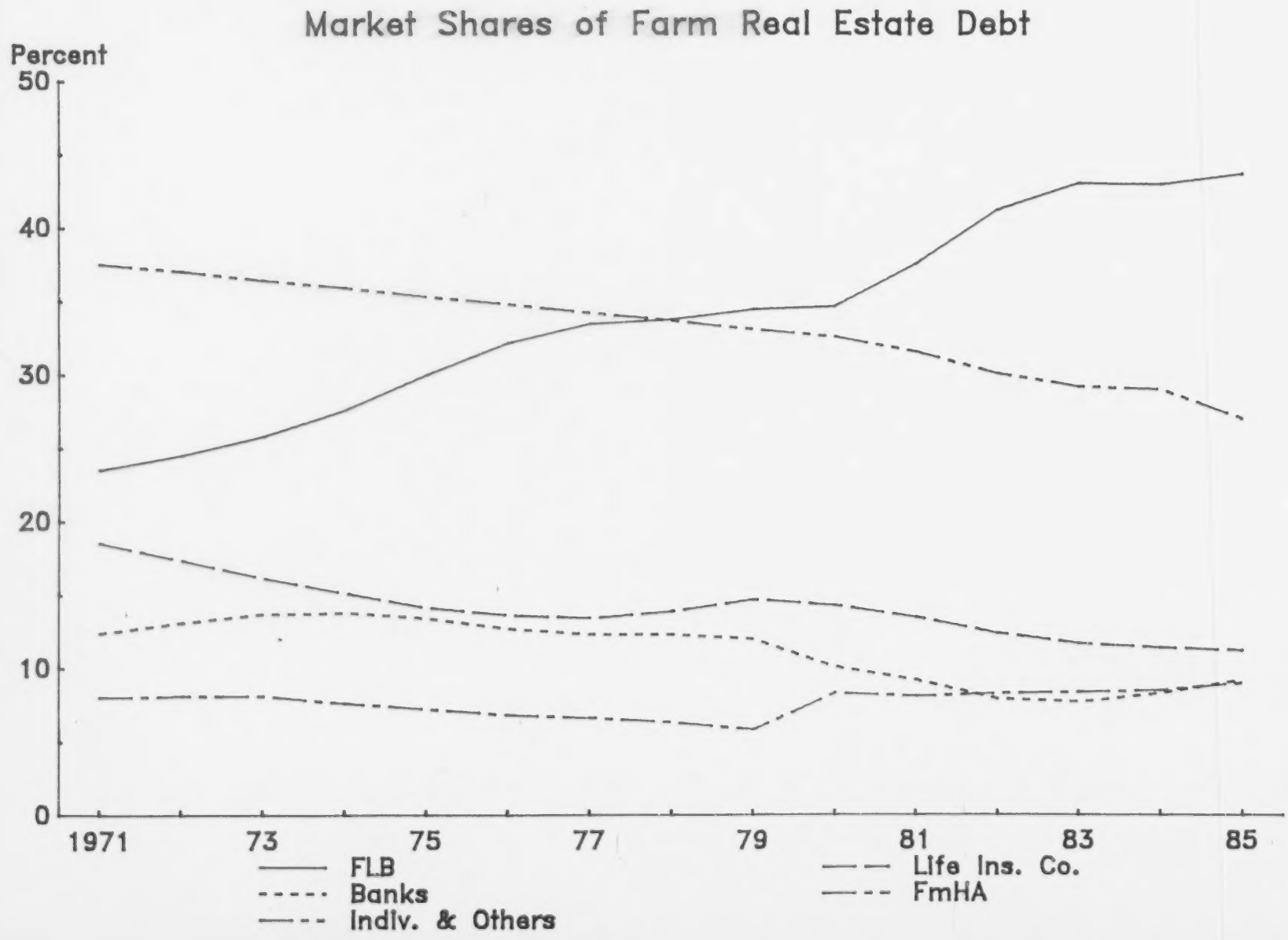
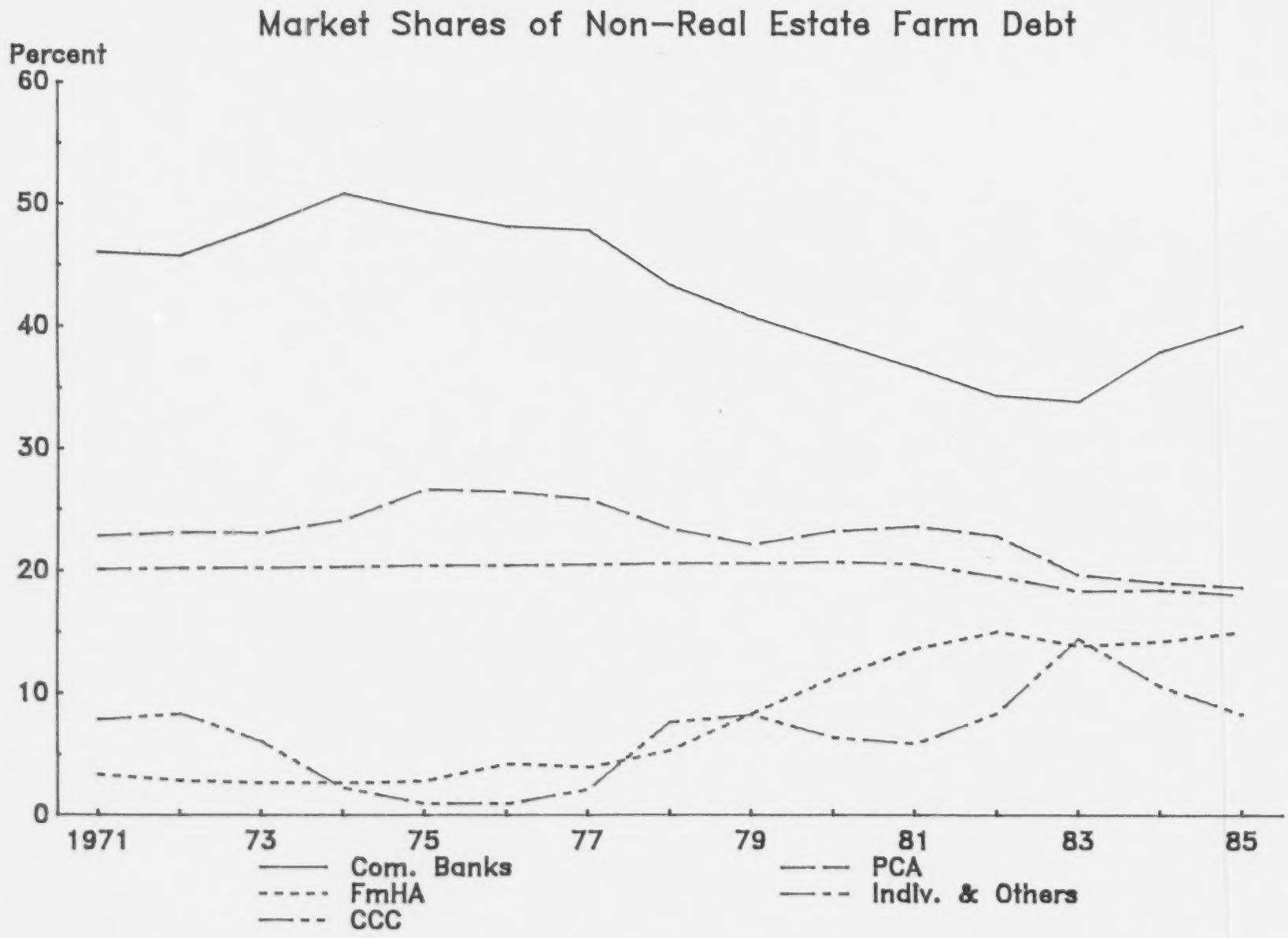

Market Shares of Farm Real Estate Debt
Percent
50
40
30
20
10
0
1971
73
75
77
79
81
83
85
FLB
Banks
Indiv. & Others
Life Ins. Co.
FmHA

Figure 1.4


Market Shares of Non-Real Estate Farm Debt
Percent
60
50
40
30
20
10
0
1971
73
75
77
79
81
83
85
Com. Banks
FmHA
CCC
PCA
Indiv. & Others

that some commercial have had in attracting deposits. In the past, legislative constraints periodically prevented commercial banks from offering competitive rates to savers. These constraints are being phased out by the Monetary Control Act of 1980.

V. EQUITY CAPITAL FOR AGRICULTURE

Equity capital, the dominant form of capital used by U.S. agriculture, arises from three primary sources: (1) profits or net income from both farm and off-farm sources, (2) unrealized capital gains, and (3) the infusion of new investment capital from persons or institutions not actively engaged in agriculture. Differences in the relative importance and access to these forms of equity capital have a direct impact on the availability of debt capital and the structure of U.S. agriculture. Each of the three sources of equity capital is described in more detail below.

Net Farm Income and Capital Gains

Table 1.3 identifies the USDA estimate of net farm income and capital gains achieved by the farm sector since 1940. Net income can be broken down into two components -- returns to operators labor and management, and residual income to equity in farm assets. As shown in Table 1.3, the decades of the 40's and 50's marked a period in which returns to operator labor and management nearly doubled the income return to equity. During the decade of the 60's, the two components of net income were about equal while during the decade of the 70's the income return to equity exceeded the return to operator labor and management. This pattern reflects the significant substitution of capital for labor which occurred over the last four decades.

The income return, whether in the form of returns to operator's labor and

Table 1.3. Income and Capital Gains Returns for the Farming Sector[a]

Year	Imputed Return to Operator's Labor and Management	Residual income to equity	Real capital gains[1]	Return as a percentage of equity value		
				From residual income	From real capital gains	Total
		---Billion dollars---		---------Percent---------		
40-49 Ave.	8.25	4.32	1.67	6.90	3.36	10.26
50-59 Ave.	9.12	4.24	2.87	3.57	2.38	5.95
60-69 Ave.	7.17	6.06	5.19	3.44	3.06	6.50
70-79 Ave.	9.00	21.55	30.05	4.46	7.86	12.32
1980	10.80	9.80	-4.50	1.30	-.60	.70
1981	12.50	17.00	-75.30	2.10	-9.20	-7.10
1982	10.70	9.90	-61.30	1.30	-7.00	-6.50
1983	9.40	4.00	-22.90	0.50	-3.10	-2.60

[a]Source: Economic Indicators of the Farm Sector: Income and Balance Sheet Statistics, USDA-ERS, ECIF 2-2, September, 1984.

[1]The change in the real value of physical farm assets (after subtraction of real net investment) plus the changes in the real values of currency, demand deposits, and farm debts. The latter changes are the January 1 dollar amounts of the assets and debts minus the quotient of the same January 1 amounts divided by the sum of the annual (January-to-January) percentage change in the Consumer Price Index (CPI) plus 1.

management or as a return on equity capital is in the form of cash. This cash can be used to meet family living expenses, to retire debt, or to reinvest in farm or nonfarm assets. Estimates of the amount of net income retained in the farming sector are not readily available, but it does seem likely that the majority of these funds would be used for other purposes, especially for family living.

Real capital gains reflect the return to equity capital from an appreciation in asset values which is greater than the rate of inflation in the general economy. In the decade of the 40's and 50's, real capital gains were on average positive and 40-70 percent as large as the residual income to equity. During the decade of the 60's real capital gains nearly equalled the residual income to equity; and during the decade of the 70's, real capital gains on average far exceeded the residual income to equity. Thus, over a 40 year period from 1940 to 1980, landowners came to expect significant real capital gains from the ownership of agricultural assets.

Since 1980, real capital gains have been negative every year, and by 1984 real wealth of the sector was down by over $160 billion from what it had been in 1979. This massive reduction in the real wealth position of agriculture has had a dramatic impact on the economic and psychological attitudes toward new investment. Purchases of capital assets such as machinery have been postponed or delayed as long as possible by many operators. Land sales languish from an overabundance of parcels offered. The problems created by this massive reduction in real wealth have been most strongly felt by farm operators with heavy debt loads. While forced sales have not yet reached substantial proportions, most observers believe that a major restructuring of asset ownership could occur as a result of the economic conditions of the early and mid 1980s. In particular, land will likely be redistributed from the highly

leveraged operators to those with a strong financial position and low leverage.

Income returns as a percentage of equity value were relatively high during the forties, but dropped to an average of under 5 percent for the next 3 decades. Since 1980, income returns as a percent of equity value have been extremely low. Total returns, measured as income and real capital gains, were relatively high in the decade of the 70's, but have been negative in recent years.

Since unrealized capital gains can be monetized only through the sale of assets or by borrowing, the magnitude of such returns may have limited direct impact on the purchases of operating inputs. However, the impact on the ability to borrow and the psychological impacts of declining real asset values will likely adversely affect the ability and desire to adopt new technologies which are costly or uncertain.

Off-Farm Income

Off-farm income is a major source of income for farm firms (Table 1.4). For example, in 1983, off-farm income accounted for nearly 60 percent of the total income per farm firm. However, as farm size (measured by annual gross sales) decreases, the relative importance of off-farm income increases.

If technological adoption occurs first on the very large scale farms (over $500,000 in gross sales) then the impact of off-farm income on technological adoption may be low since such income is a relatively small component of total income for the largest farms. In contrast, if technological adoption occurs first on small or medium size farms, off-farm income may be an important source of income to finance technology adoption.

Table 1.4 Farm and Off-Farm Income Per Farm Operator Family, 1983[a]

Farms With Gross Sales of	Net Farm Income	Off-Farm Income	Total Income From Farm and Off-Farm Sources
		--Dollars--	
$500,000 and over	$567,585	$ 28,603	$596,188
$200,000 to $499,999	$ 62,233	$ 14,610	$ 76,843
$100,000 to $199,999	$ 26,681	$ 11,793	$ 38,474
$ 40,000 to $ 99,999	$ 10,654	$ 11,253	$ 21,907
$ 20,000 to $ 39,999	$ 2,945	$ 13,547	$ 16,493
$ 10,000 to $ 19,999	$ 263	$ 18,061	$ 18,324
$ 5,000 to $ 9,999	$ - 155	$ 20,047	$ 19,891
$ 2,500 t0 $ 4,999	$ - 701	$ 20,210	$ 19,509
Less than $2,500	$ - 361	$ 21,655	$ 21,294
All Farms	$ 11,749	$ 17,299	$ 29,048

[a] Source: Economic Indicators of the Farm Sector, ECIFS 3-3, U.S. Department of Agriculture, September, 1984.

New Equity Capital

Capital from the sales of stocks in corporation or shares of partnership interest has been a rather limited source of equity capital for agriculture. In the past shares of partnership interest have generated significant amounts of new equity capital for large cattle feeding and poultry operations. These investments were motivated by favorable tax laws--laws which have since been changed.

At present, there is considerable interest on the part of farmers in the possible infusion of new equity capital to assist financial distressed operators with large debt loads. Interest on the part of investors is rather limited. However, significant amounts of new equity capital have been raised to invest in new technologies in agriculture. For example, much of the equity investments for embryo transplants in dairy cattle has come from nonfarm investors. Thus, while new equity capital may be a small component of the total equity capital in agriculture, it may be used to finance some of the new technologies where risks and payoffs are expected to be high.

V. SUMMARY

Capital availability, technology adoption, and structural change are interrelated factors which will influence the future direction of U.S. agriculture. Emerging technologies appear to be of the form that will require expenditures for new chemicals, seeds, embryo transplants and other operating inputs. These inputs are normally financed with operator equity capital or short-term loans.

Capital available in agriculture is of two forms -- debt capital and equity capital. Debt capital accounts for about 20 percent of the capital used by agriculture while equity capital accounts for the remainder.

Over time, the importance of debt capital, and the sources of that debt capital, have changed. The increasing importance of debt capital gives lenders a larger role in decisions involving new technologies used by farm operators. Likewise, changes in the market shares of debt have shifted toward the Farm Credit System for farm real estate debt and government lending agencies for nonreal estate debt.

Equity capital in agriculture arises primarily from retained earnings and unrealized capital gains. From 1940 to 1980, the importance of unrealized capital gains grew relative to earnings. Since 1980, farm earnings have fallen but have remained positive for the sector as a whole. In contrast, deflation in asset values since 1980 have wiped out a significant amount of the real capital wealth of the sector. The impact has been a substantial reduction in wealth to finance new investments and a psychological impact that has created a mood of pessimism for many operators.

Off-farm income of the farm population has exceeded net farm income in recent years. However, the relative importance of off-farm income declines as farm size (measured by gross sales) increases. If larger farms are the most likely adoptors of new technologies, this suggests that off-farm income of farmers plays a relatively small role in technology adoption in agriculture.

New equity appears to be a rather limited source of capital for agriculture. Yet such equity capital has been a major source of capital for new ventures like embryo transplants in dairy cattle. Thus outside equity capital is likely to play a significant role in the adoption of new technologies in agriculture.

Background Paper No. 4

Regulatory and Performance Issues for Financial Institutions: Their Effects on Technology Adoption and Structural Change in Agriculture

Peter J. Barry
University of Illinois

October 1985

Office of Technology Assessment
U.S. Congress

The author gratefully acknowledges the helpful review comments received from Michael D. Boehlje, John R. Brake, John A. Hopkin, Warren F. Lee, David A. Lins, Ronald Meekhof, John B. Penson, and David Trechter.

This background paper was prepared for the assessment "Technology, Public Policy, and the Changing Structure of American Agriculture." The views expressed are those of the author(s) and not necessarily those of OTA.

Regulatory and Performance Issues for Financial Institutions: Their Effects on Technology Adoption and Structural Change in Agriculture

Peter J. Barry
Professor of Agricultural Finance
University of Illinois

The research and development activities associated with the creation of new technologies for agriculture in general are undertaken to increase production efficiency, improve the quality of food, protect the environment, conserve natural resources, and enhance biological pest control. In the final analysis the technologies must offer superior economic performance at acceptable levels of confidence, relative to existing processes, in order to be considered for adoption by commercial producers. In addition these technologies must be financially feasible in order to encourge adoption. Thus, the tests of economic and financial feasibility are crucial in projecting the adoption, use, and aggregative effects of new technologies.

In its study of new technologies in agricultural production, the Office of Technology Assessment has identified a rich set of emerging technologies in crop and animal production that are projected for likely adoption by agricultural producers. An unknown factor, however, is the financial consequences of these new technologies for agricultural production units with different structural characteristics. The financial consequences include both the performance effects (profitability, risk, liquidity) for agricultural producers and the cost, availability, and other terms of financial capital (credit, leasing, equity). Also important are the role of public credit policies in the adoption process and other potential structural changes in agriculture.

The purpose of this paper is to consider the relationships among technology adoption, financing consequences, and the structure of agriculture. The major financing focus is on the credit component of financial capital, and how the regulatory and competitive changes of U.S. financial markets during the 1980s will influence the cost, availabililty, and other terms of credit for agricultural producers, and the consequences for structural change. In the following sections, some background information on credit and farm structure is reviewed and an analytical framework is established for understanding the relationships among credit, technological change, and farm structure. Then various changes in the regulatory environment affecting major farm lenders are reviewed with implications developed for technology adoption and structural change.

Credit Policy and Structural Issues in Agriculture

The impacts of credit and credit policies on structural change in agriculture can be viewed from two vantage points: 1) a broad view of the farm production sector as an aggregate unit structured to achieve desired social objectives, and 2) an intra-sector view that considers changes in the sector's make-up over time. Viewed from the broad vantage point, credit arrangements and policies of the past are believed to have contributed to maintaining a structue of the farm production sector that, compared to many other sectors, largely has a smaller scale, pluralistic, non-corporate, competitive market organization of ownership, management, and control. These characteristics presumably have been consistent with social objectives for agriculture, including low cost, abundant, and reliable supplies of food and fiber, although empirical verification of this situation needs further testing. Some examples of these past credit

arrangements and policies include: 1) creation and evolution of the Cooperative Farm Credit System; 2) maintenance of a dual system of commercial banking (basically, large and small banks) with some special provisions for financing agriculture; 3) creation of government credit programs for agriculture--the Farmers Home Administration (FmHA) and Commodity Credit Corporation (CCC) at the federal level and various credit programs at the state level; 4) actions and policies taken by federal and state governments to discourage or impede the flow of outside equity capital into the agricultural production sector; 5) laws to protect the interests of tenants and thus encourage the traditional leasing arrangements for farm land; and 6) encouragement of seller financing of farm land that keeps the financing function within local communities.

Given this broad view of the farm production sector, credit arrangements and policies also have facilitated various structural changes within the sector. Included are the mechanization and modernization of farm units, greater capital intensity, growth in farm size (and reductions in farm numbers), greater leverage from debt and leasing, greater market coordination, and others. Credit also plays an important risk bearing role through the liquidity provided to cope with risk and the various alternatives in debt management for restructuring and rescheduling farmers' financial obligations. However, special credit programs and concessionary terms also are believed to have highly sensitive, adverse effects on resource allocation, asset values, and risk positions. That is, these credit programs may on occasion tend to over-facilitate changes or hamper long term resource adjustment.

In general, then, a reasonable consensus of past studies and observations (U.S. Department of Agriculture; Farm Credit Administration; Lins and Barry, 1980; Lee et al) on the relationships between credit and structural change in agriculture is two-fold. First, the availability of credit is a necessary condition for undertaking investments and other activities (including adoption of new technology) that result in structural change; however, credit availability is not a sufficient condition--basic economic incentives are needed as well. Second, credit and credit policies can be a facilitating instrument for structural change in agriculture, but not very effective ones since the unintended effects may outweigh the intended positive effects. That is, the special credit policies sometimes may result in too much use of credit, too much risk taking, higher land values, and slower mobility of some resources.

Credit and Financial Market Concepts

In evaluating the costs and availability of credit to finance new technology, and the structural issues involved, some of the basic concepts of financial markets should be reviewed. One of the vital functions of a financial market is to channel funds accumulated from savers into productive use by investors who lack the financial capacity to fully finance their own activities. The specialized financial intermediary reduces the transactions cost for the parties involved, and through pooling concepts can reconcile differences in risk and liquidity preferences between savers and investors, thus adding to overall social welfare. The funds and resulting securities may be either equity capital or debt capital with the latter characterized by the investors' (borrowers') promises to repay the funds over or at a stipulated time period with a known form of compensation (generally called interest). The interest payment is

fixed in the sense that it is independent of the borrowers' profit performance, although many debt arrangements may allow the interest rate to vary with changes in the lenders' cost of funds.

The financial markets for various types of savers (e.g. individuals, businesses, etc.) and investors (e.g. farmers, corporations, home owners, government, etc.) may differ considerably in their competitive characteristics. Significant imperfections may occur due to high risks, weak information systems, few participants, and high transactions costs for the assets being financed. In cases like agriculture and housing, the public sector has responded to these imperfections through authorization of specialized financial institutions and direct lending programs. These responses are intended to give investors access to financial capital on terms comparable to those of other economic sectors.

Major features of financial markets are the intangible nature of the financial assets and services, the high leverage of financial institutions, and the resulting needs for confidence, trust, and stability required to make these markets function effectively. Thus, the financial markets experience substantial regulation in order to safeguard savers and investors, modify competition, respond to imperfections and gaps, and contribute to monetary stability. Regulations may take many forms: limits on geographic scope of financial institutions; ownership structures and controls; mandatory specialization in some activities; portfolio diversification through reserve and capital requirements, loan limits, and asset allocations; interest rate controls, special borrowing privileges; fair trade practices, public programs for credit and insurance; and laws affecting the design, trade, and

negotiability of financial instruments (Barry, 1981).

Most regulations yield many of their intended positive effects. However, they also may impose substantial costs on financial market participants as changes occur in economic, social, and institutional conditions. When these costs become excessive, the stage is set for regulatory change. As discussed below, this was indeed the case in the 1980s. Thus, the financial market and regulatory environment as well as financial conditions in agriculture influence the cost and availability of credit for farmers.

Credit Determinants and Relationships to New Technologies

The availability and cost of credit to agricultural producers are based on a number of determinants that may change over time and that may differ among financial institutions. Some credit determinants originate in the financial markets. These include both macro and micro conditions. Macro conditions reflect monetary and fiscal policies, inflation, savings rates, and other forces, both domestic and international, affecting interest rates, money supplies, and credit use. Micro conditions reflect the responses of both financial institutions and borrowers to changes in the market and regulatory environment.

Other credit determinants originate in agriculture through the macro effects of supply-demand conditions for commodities and resources, and through factors affecting the credit-worthiness of individual borrowers. Credit worthiness is based on those fundamental factors that lenders use to evaluate a borrower's ability to meet his financial obligations. These credit factors basically include the borrower's personal characteristics, management ability,

repayment expectations, assets available as security to collateral and past credit experiences and financial progress.

In this paper, the primary focus is on the relationships between credit terms from the major farm lending institutions and changes over time in these in these institutions' regulatory and competitive environment. For the above credit determinants, this focus primarily involves the micro conditions of these lending institutions, although the inter-relationships with various macro finance forces are important too. Also important are the impacts of new technologies on the credit worthiness of farm units with different structural characteristics, and the implications for the cost and availability of credit.

From a credit-worthiness standpoint, most of the new technologies projected by OTA for adoption involve refinements in production processes without requiring large capital outlays by agricultural producers. This is especially true for technologies involving genetic engineering, diseases and pests, fertility and nutrition, etc. They should largely be embodied in the operating inputs used by crop and livestock operations to carry out production. Credit for acquiring most of these technologies likely will come from short term operating loans with loan repayment occurring from the sale of products being produced. For crops, the sales may be at harvest or over a marketing year as stored inventories are liquidated. For livestock, the sale time is based on market readiness of the animals and by-products involved. Most of these new technologies should be financed by short-term, self liquidating loans that are highly preferred by most lenders. Moreover, as normally occurs in production loans, lenders will take security interests in the products being produced (e.g., growing crops, marketing contracts, feeder livestock, milk

production, etc.) in order to provide the necessary loan collateral. In many cases, security interests will also be taken in the borrowers's capital assets (e.g., machinery, facilities, breeding livestock) in order to provide a broader collateral base, especially when the same lender finances both operating inputs and intermediate term capital assets.

For those new technologies involving fixed capital, as with systems for environmental control, irrigation and water management, performance monitoring, and information and communication, the capital outlays will be greater and the economic payoff periods will be longer. Credit arrangements for these technologies will likely involve intermediate or longer term loans with security interests in the capital assets serving as loan collateral. Important considerations are the length of payoff period for these technologies and the time pattern of returns. Some of the assets may be highly specialized with low liquidity and high transactions costs in the event liquidation must occur. Others will be more easily transportable with lower transactions costs and thus greater liquidity.

In general, then, according to evaluations of credit worthiness based on repayment expectations and collateral alone, the new technologies should not encounter financing limits or other loan terms that differ much from those for other types of agricultural assets. However, a more important lender response will likely involve the management skills and risks associated with using these technologies. Clearly, more complex technological systems will demand greater skills in both management and labor for their effective use. In some cases considerable investments in human capital by agricultural producers may be needed to provide the necessary management skills. Complementary investments in computers and information processing technologies may also accompany the

adoption and use of new technologies. Both of these factors may involve financing requirements and thus influence the borrower-lender relationship.

From the risk standpoint, considerable uncertainty may arise about the proper use and payoffs from these technologies, especially in the early stages of adoption and use. Moreover, the market values of some new technologies could drop rapidly either due to obsolescence or lower production costs as sales increase. Thus, lenders will place greater emphasis in credit evaluations on the ability of agricultural producers to rigorously demonstrate that they have the necessary resources and skills in management and labor to effectively use the new technologies, and that risks are not excessive. Moreover, lenders themselves must be able to understand the new technology and communicate clearly with borrowers about its adoption, use, and financial consequences. These features will likely favor those lending institutions that have the size, expertise, funding capacity, and other characteristics to make a substantial commitment to agricultural finance.

Perspective on Regulatory and Competitive Changes in Financial Markets

During the 1980s virtually all of the major farm lenders have experienced significant changes in their competitive environment due to the combined effects of numerous factors. Among these factors are the following: 1) the high, volatile inflation rates of the 1970s and early 1980s and the related pressures on interest rates; 2) the strong growth in competition for funds and financial services from new entrants to the financial services industry (Sears, Merrill Lynch, J.C. Penney, money market mutual funds, and others; 3) the new technology in financial markets involving electronic transfers of funds and cash

management services; 4) the financial stresses affecting many borrowers; and 5) the regulatory changes affecting financial institutions, with heavy emphasis on deregulation. The regulatory changes are considered in the following sections.

Regulatory and Performance Issues Affecting Depository Institutions

At the beginning of the 1980s the major areas of regulatory change affecting commercial banks and other depository institutions have involved four areas: 1) the decontrol of interest rate ceilings on deposits and loans; 2) controls on ownership forms and geographic scope--the branching and holding company issues; 3) the range of products and services these institutions can offer; and 4) the adoption of uniform federal reserve requirements for all depository institutions. The major legislation enacted by 1984 included the Depository Institutions Deregulation and Monetary Control Act of 1980, and the Garn-St. Germain Depository Institutions Act of 1982. These acts focussed primarily on the decontrol of interest rates, changes in reserve requirements, aid for ailing thrift institutions, as well as many other specific provisions. In addition, several bills were under consideration by the House and Senate in late 1984 affecting the range of products and geographic liberalization.

Interest Rate Deregulation

The deregulation of interest rate ceilings on bank deposits--called Regulation Q--was largely complete by 1984. This has made the pricing environment more similar among depository institutions, and greatly reduced the historic insulation of rural banking markets from national and even international forces. The levels and volatilities of banks' costs of funds have

increased and virtually all of the funding sources for banks have become rate sensitive. In response, banks of all types and sizes have adopted more market oriented pricing policies for loans, funds acquisition, and services, and have moved toward improved methods of managing assets and liabilities. Greater emphasis has been placed on the use of such techniques as floating rates, risk assessment and pricing, spread and gap management, matching maturities, interest rate hedging, cost accounting, loan documentation, and market analysis. The traditional loan-deposit relationship at the customer level is changing too with more emphasis on revenue generation from borrowers compared to deposit balances and related lending terms. Most of these new banking practices were initially undertaken by larger banks and holding company systems, although their use by smaller banks has increased as well.

In the early stages of interest rate deregulation, most small banks have been able to maintain strong profit performance. Banking data indicate, for example, that the average annual after-tax rate of return on equity capital for about 4,300 "agricultural" banks (banks with ratios of farm loans to total loans of .25 or above) was 14 percent for the 1970s. This figure climbed to 16 percent in 1980 and then started down: 15 percent in 1981, 14 percent in 1982, and 11 percent in 1983. Most of the decline appears attributable to higher loan losses, including those on farm loans, rather than narrower margins between loan rates and cost of funds. But, the full story likely is not yet available on banks' profitability responses to both financial stress in agriculture and financial deregulation. These two phenomena may be closely related since banks have responded to higher, more volatile costs of funds by passing risks on to borrowers through floating loan rates and other loan repricing methods. This in turn has caused greater financial distress for many borrowers that then reverts

back to the lender through higher loan risks, more delinquencies, and greater loan losses. Moreover, the banks' practice of responding to these credit problems by spreading the increased lending risk over other borrowers through higher risk premiums in loan rates has likely widened the incidence of credit problems in agriculture. This, of course, reflects the strong market power of most banks in local credit markets. However, it also means that the profit position and lending capacity of many agricultural banks could deteriorate further in the future as lagged responses occur to farmers' stress positions, and as the competitive pressures of financial deregulation become more intense.

An offsetting factor to these interest rate conditions for banks and borrowers is that interest rate deregulation has relieved the disintermediation pressures of the past and reduced the likelihood of periodic credit crunches in which the bank's availability of loan funds is dried up. Thus, the past risk of swings in credit availability, and the attendant liquidity problems for banks and borrowers has shifted strongly to swings in interest rates. This in turn gives clearer signals about changes in financial markets and improves the efficiency of financial markets.

Banks Products and Services

The second line of deregulation is focussing on possible changes in the products and services that banks and other depository institutions may offer. Many banks are seeking greater authorities to offer insurance, real estate brokerage, securities underwriting, equity participations, and other nonlending activities. In addition some banks are becoming more active in adopting, using, and merchandising information processing activities that meets their own needs

for information (e.g. credit evaluations) while offering information services to customers (e.g. accounting systems). The products and services area is fundamental to the uniqueness of banking and whether banks should retain their traditional identity and deposit creating function given their monetary role. It will receive careful scrutiny and much debate in the policy arena. Nonetheless, additional liberalization of banking powers seems likely given the thrust of competitive market forces. The effects on rural credit may not appear significant, although indirect effects may occur if new banking products have favorable profit prospects relative to lending.

Geographic Structure Issues

The third major line of regulatory change involves the geographic scope of banking. A long standing U.S. philosophy has been to let individual states determine branching and holding company activities within their boundaries. Various laws have prohibited national branching, given state branching authority to each state, and prevented bank holding companies from crossing state lines unless agreed to by the states involved. The result has been a diverse set of state limitations on branching and holding companies.

Considerable attention has focussed on liberalizing these geographic restrictions. But, except for savings and loan associations and other thrift institutions, Congress was only beginning to address these issues in 1984. The approach in the recent past has mostly involved letting individual states initiate geographic liberalization, using reciprocal authorities granted in existing legislation. In addition, greater discretionary relaxation by the various regulatory agencies has occurred. This approach essentially allows the drift of market forces to work, with considerable aggressiveness exhibited by

many banks and banking systems. Examples of these movements have included the development of regional banking markets especially among states in the Northeast and Southeast, the creation of nonbank banks (banks that do not simultaneously make commercial loans and take deposits), and the rapid expansion of multibank holding companies in states that have eased restrictions on these activities. All of this is occurring within the traditional framework of correspondent banking and within past authorizations for loan production and Edge Act offices that allowed national and international lending markets at least for the largest banks and borrowers. It is also occurring within a less geographically restrictive framework for other depository institutions (savings and loan associations, credit unions) as well as for foreign banks with U.S. offices.

The future prospects for geographic liberalization in banking suggest a moderate pattern of deregulation that avoids the formal authorization for national branching, even though national markets essentially occur for larger banks and banking systems. Moderate deregulation should impact more heavily on smaller institutions than on larger ones; thus, the number of banking entities in the U.S. should decline significantly--perhaps by one-third by the mid-1990s. However, public pressures likely will continue to provide various types of protection for smaller community banks that have been so prominent in states that have prohibited branch banking. Moreover, the financial stresses being faced in many unit banking states during the 1980s may accelerate the trend toward reciprocal banking agreements among states in order to broaden the market for failed and stressed banks.

The surviving banks will be higher performing community banks, that are well managed, well capitalized, and strongly localized in their services. They will serve portions of the financial markets that are not well suited to the scale and technology of the larger banking systems. These banks will give

considerable attention to the competitive pricing of products and services and to market segmentation, including specialization in activities like agricultural lending.

In general, geographic liberalization should bring greater competition in all phases of banking. This will put downward pressure on bank earnings, but contribute positively to the availability, cost, and usefulness of financial services for customers. Banks may take on greater risks but have greater risk carrying capacity through increased diversity in loan portfolios, larger resource bases, greater depth and breadth in management, and the discipline exerted from market factors rather than from regulations. For agricultural finance, geographic liberalization should enhance the availability of credit services, although more along the lines of commercial lending procedures for commercial scale farmers and consumer lending procedures for small, part-time farmers.

A continued swing will occur toward greater financing from larger, more sophisticated banking systems with these larger systems seeking the business of larger farm units and agribusinesses. Smaller independent banks with strongly localized customer orientations will make substantial use of funding and service relationships with larger banking systems. This will be similar to the correspondent arrangements of the past, although the correspondent institutions themselves will be operating in larger markets. In the near term some banks may seek to further develop funding and loan participation arrangements with various units of the Farm Credit System, although over the long term bankers prefer a reliable, cost effective source of nonlocal funds within the banking industry. The funding mechanism provided by MASI, Inc. (a division of Mid-America Banking Service Company, MABSCO) is a step in this direction, in which participating

banks in more than a dozen states may discount acceptable farm loans with a funding source in the national-international financial markets. This future funding also should include the ability to make long term real estate loans in a fashion that does not jeopardize bank liquidity or increase interest rate risks.

In light of these developments, the location of credit controls and loan decisions may continue to shift away from the local community; however, the availability of experienced, well-trained farm lenders in rural areas should maintain an emphasis on local servicing of farm loans, while still fostering greater uniformity in loan documentation, risk assessment, and other lending practices. This standardization should benefit both the financial institutions and farm borrowers.

Regulatory and Performance Issues Affecting the Farm Credit System

The major legislative authority of the Cooperative Farm Credit System (FCS) is the farm credit act of 1971. This act updated and consolidated much of the preceding legislation that had developed over time in a piecemeal fashion. The Farm Credit Act Amendments of 1980 further updated and improved the operation of the system and marginally expanded its scope of operation. Then, the Farm Credit Act Amendments of 1985 strengthened the regulatory authority of the Farm Credit Administration (FCA) and provided an organizational framework for coping with financial stress in agriculture, including possible financial assistance from the federal government. In general, the system's legislative authority defines its mission as one of providing appropriate

credit and related services to eligible, credit-worthy agricultural borrowers throughout the U.S. during all phases of the economic cycle in order to improve their income positions and overall well-being.

The FCS is specialized in financing agriculture. Thus, local associations and individual districts are vulnerable to the problems affecting their borrowers. Moreover, due to its cooperative organization, much of the system's equity capital is owned by farmers who in turn financed this equity contribution with funds borrowed from the system. However, a number of factors have helped the system counter the risks arising from this mandated specialization. Included are: (1) The system's national structure of full-service agricultural lending; (2) Diversification of loans across borrowers, associations, districts, and farm types; (3) Loss sharing and participation agreements among the various banks and associations; (4) An historically strong financial position and credit history; (5) Efficient operations with low per unit costs of funds management, loan administration, and so on; and (6) A system-wide emphasis on risk management. These characteristics along with regulatory privileges in funding (see below) have enabled the FCS to grow significantly over time to become the largest farm lender, especially in long-term lending.

Like other lenders, the FCS has been significantly affected by the financial stresses of agriculture in the 1980s. Most indications during the early 1980s were that unless farm losses became extremely heavy and widespread, the FCS should come through the stress times in reasonably good shape. Loan volume had declined for some units, higher loss rates were occurring, some borrowers were discontinued, more associations were

merging, and intra-system assistance packages were developed for some units. Moreover, the FCS had taken several actions to strengthen its liquidity and build its risk management. Some of these actions involved continued restructuring of the system's capital positions, operations, and management through greater centralization of these functions at the system, district, bank, and association levels. In general, the overall financial structure of FCS remained relatively strong through the middle of the 1980s and the system's capacity to sell securities in financial markets was not impaired. Nonetheless, policy makers, regulators, and others continued to maintain close surveillance of the system's performance.

Then in the fall of 1985 the governor of the FCA with subsequent agreement by the leadership of the FCS concluded and announced that substantial federal assistance could be needed in the next 18 to 24 months to keep the system solvent if farm financial conditions continued to deteriorate. After much debate, including concerns about the standing of the system's securities in the financial markets and equitable treatment for other troubled farm lenders, federal legislation was passed that strengthened the regulatory authority of the FCA, strengthened the system's capacity for handling problem and loss loans, and essentially provided a contingent line of credit from the federal government if the system's own reserves proved inadequate to deal with continuing financial problems in agriculture. While further regulatory changes likely will occur in the future, these developments should enable the FCS to come through the stress times in reasonably good condition.

Moreover, over the long term, the FCS is clearly taking actions to perform more effectively in a more competitive, deregulated financial environment. One such action during 1983-1985 has been the initiation of a significant self-study (called Project 1995) of the System's future missions and directions in all phases of its activities (agricultural financing, financial markets, government affairs, personnel, and management). Other actions have in general reflected the emergence of FCS as a vigorous commercial entity seeking to achieve high performance on behalf of its member borrowers. Among these actions have been a stronger emphasis on the development and marketing of new products and services; the continuing trend toward centralization and unification of territorial boundaries, management, service provision, and other functions; the formalization of government affairs activities through trade association arrangements; and a moderately-paced expansion of international activities.

From a policy perspective, the FCS has also been caught up in the swift and significant changes in regulation and competition affecting the U.S. financial system. The effects have been less direct than on depository institutions but, over a longer term, basically involve the trade-offs between 1) the needs by the U.S. agricultural sector for a specialized, reliable, nationally oriented credit system with special privileges in the financial markets, versus 2) the trend toward greater openness in financial markets with less emphasis on regulatory preferences in funding and mandated specialization in asset allocations. These issues began to emerge during the debate preceding the passage of the Farm Credit Act Amendments of 1980. Much concern arose about the concept of a "level playing field" in the regulatory environment for commercial banks, the FCS, and

other types of lenders. The debate occurred at the beginning of the deregulation process and has continued in various forms. Included in the debate were differences among institutions in their access to financial markets (the agency status issue), geographic restrictions, tax obligations, legal reserve requirements and lending limits, stringency of regulation and supervision, and the range of financial services and borrower clientele for these types of institutions. None of these issues affecting FCS were fully resolved in the debate on the 1980 Act, although the legislation that was finally passed did reflect responses to some of the concerns raised by commercial bankers and others.

Following 1980, much attention in policy circles has focussed on the "agency status" of the securities that the FCS sells in the financial markets. While the FCS is privately owned and operated, the securities they sell still have some special regulatory privileges giving rise to the "agency status" label. To some extent, agency status is a vestige of earlier times, when the FCS had significant government involvement and formal backing. However, the System's securities still have a set of regulatory exemptions and preferences that have continued after FCS reverted largely to a private status in the late 1960s (Lins and Barry, 1984; Barry, 1984). This status helps the System achieve a very large volume of security sales at interest costs that are just above those of the U.S. Government and below those of the largest, most credit-worthy corporate issuers.

Several groups have studied the possible effects of removing agency status. While these effects are difficult to measure precisely, the general concensus is that loss of agency status would increase the interest cost on farm credit

securities to the interest rate levels of high grade corporate bonds or commercial paper. This might be an increase of one-half to one percent, or even more. In addition, the volume of marketable securities could decline significantly, since the past volume of these sales far exceed the annual volumes of the largest corporate issuers. A contrary view, however, is that even without agency status the financial markets are efficient and deep enough and the Farm Credit securities have a favorable enough a record that the entire funding needs of the system could still be met, although at higher interest rates.

The agency status issue will eventually be resolved by the political process that, in the mid-1980s, has favored continuation of agency privileges for FCS, especially in light of the financial stresses affecting agriculture. But, it seems likely that attempts to remove agency status will continue as has been the case for some of the housing agencies whose securities also have agency status. The FCS in it own self study believes that government sponsored agencies can probably retain agency status in some form through the mid-1990s. However, political pressures toward privatization will continue and will bring higher costs for the agencies involved, and perhaps greater interest in broadening their authorizations in funding methods and asset allocations as various agency attributes are diminished. Indeed, having a reliable source of funding is essential if FCS is to retain its mandate to provide credit in all regions of the U.S. and through all phases of the economic cycle. Thus, the agency status issue has important policy implications that affect the financial markets in general, the farm credit markets in particular, and especially the costs and availability of credit from FCS. In turn, these effects will have

important implications for the structure and performance of the agricultural sector.

Public Credit Programs

Public credit programs currently administered through the Farmers Home Administration and the Commodity Credit Corporation, at the federal level, and in numerous state governments as well, have long been important in achieving social objectives for the U.S. agricultural sector. These programs help channel funds to selected geographic areas and types of borrowers; they help foster a smaller scale, pluralistic structure for the farm sector; they provide financing opportunities for beginning and limited resource farmers; they provide valuable liquidity for emergency situations; and, in the case of CCC, they contribute valuable inventory financing to promote orderly marketing of farm commodities. In addition, from a policy maker's standpoint, credit programs are a popular, politically expedient policy instrument. They are relatively to easy to administer; the administrative and risk bearing costs are difficult to measure and effectively hidden from taxpayers; they are highly visible to constituents; they can be quickly developed for responding to ad hoc crisis situations; and they do not directly influence commodity and resource markets, even though the secondary effects on asset value, income and risk can be significant.

The growth in FmHA lending has been substantial since the late 1970s, especially through various emergency loan programs. This lending helped considerably in softening the impacts of high interest rates and weak farm income on some farmers and relieved commercial lenders of many problem loans.

But this liberal lending may have helped worsen some farmers' financial conditions. Some observers have suggested that part of the financial stress of farmers is due to excessive public sector lending and that more credit will only worsen the conditions of highly levered farmers, and needlessly delay the departure of some from the industry. Similar observations over a longer term perspective suggest that strong government lending may have overfinanced the farm sector, accelerated the adoption of capital-intensive technology, shifted too much risk bearing to the government, and capitalized the effects of easy financing terms into higher values of land and other assets.

Much concern has surfaced about the role of special credit treatment in agriculture, the proper balance between private and public sectors, which farmers are served, the level and form of subsidies, and the resulting tax burden. These are sensitive issues in the public arena. On the one hand the stresses of the early 1980s have brought increasing pressure from farmers, farm groups, and others to provide additional public assistance to solve these problems. Yet, at the same time, the liberal, high cost public programs of the recent past have had growing dissatisfaction and closer scrutiny by nonfarm groups as well as by those farmers with stronger financial positions and less indebtedness.

In terms of regulatory change, the public programs have not, of course, experienced the same considerations of deregulation as affects lenders in the private sector. Nonetheless, these public programs must still operate under various regulations and practices affecting interest rates, lending limits, credit decisions, eligibility of borrowers, disaster declaration authorities, and relationships with other lenders. In general, the interest rates on public loan

programs now reflect the level and frequency of changes in the government's costs of funds. Thus, interest rates on public credit follow market interest rates much more closely, and while rate levels are higher than in the past, they still are more favorable than commercial loan rates. An exception occurs in the case of various emergency loan programs in which significant concessions in interest rates may occur for the affected borrowers.

Lending limits on various loan programs in general are still set by law rather than individual credit factors. These limits provide controls on the magnitude of appropriations, and impose an administered allocation of loan funds among eligible borrowers. The limits tend to adjust upward over time to reflect the effects of inflation and the costs of establishing and operating viable farm businesses. However, the adjustments occur at sporadic intervals with no formal indexing to other measures. A continuing dilemma in setting loan limits involves the choice between the levels of credit needed by individual borrowers to move in an orderly way toward eventual graduation to commercial financing, versus the preference to spread an allocation of funds that is fixed in the short run among the greatest possible number of borrowers.

Closely related to lending limits for individual borrowers are the issues associated with the allocation of funds among various states and regions and over the various loan programs. It is not unusual for funds in some uses and locations to be fully allocated part way through a budget year so that otherwise eligible late comers may find that loan funds are depleted. This process may then trigger the need for new appropriations, re-channeling of funds from other uses, discretionaty rationing, or other responses. Thus, lending limits at the

agency, program, and borrower levels may introduce considerable uncertainty about the availability of credit.

Another administrative issue in FmHA lending involves the form of credit programs--that is, the choice between direct (insured) loans and guarantees of loans made by commercial lenders. To date, nearly all FmHA lending to farmers has occurred through direct loans, even though both programs are available. In concept, direct loans and guaranteed loans have similar effects in that the bulk of the credit risk is still carried by the government. However, the guarantee approach is considered to involve lower degrees of subsidy and to more formally involve the commercial lender in the credit decision and loan servicing. Thus loan guarantees can be a more efficient method of program design that has less disruptive effects on credit markets. Some of these possible benefits have been offset, however, by the commercial lenders' perception of a costly process of using the guarantee program, and by the greater effectiveness of direct loans in emergency situations. In response, Farmers Home has sought to simplify procedures for using guarantees through a "preferred lender" program that expedites the private lender's use of the program.

Another administered change has involved the centralization of decision authority for declaring disaster conditions in various geographic areas. In the past the location of these authorities at the state level gave too much incentive to the parties involved to declare emergencies in their repective states in order to qualify for low cost emergency loans. Centralizing this decision authority was believed to allow the allocation of emergency funds on a more objective basis.

At the state level, a number of states have developed farm credit programs with a heavy emphasis placed on financing the acquisition of farmland and other

capital assets by younger farmers (Lowenberg-Deboer and Boehlje). These programs vary considerably, but tend, like FmHA, to have a set of regulations affecting borrower eligibility, loan purposes, loan limits, budget limits, interest rates, and so on. Heavy emphasis in many of these programs has been placed on lending financed by tax-exempt bonds and on various types of tax incentives affecting land purchases and leasing by young farmers. The tax exempt bond programs appear to be less cost-effective compared to other program methods since they essentially involve the federal government in sharing the state program costs. Recently, the federal authorizations for states to offer tax-exempt bond programs have been curtailed, with further limitations anticipated for the future. In the future, the general importance of state credit programs could increase especially if federal credit programs are cut back. However, the scope, missions, and instruments used in these programs likely will receive careful review and revision to assure that the programs are formulated in the best public interest of the states involved.

Implications for Technology Adoption and Structural Change in Agriculture

The discussion in the preceding sections has indicated that the financing consequences of new technologies in agricultural production will likely depend on the relationships among three important factors: 1) the financing characteristics of the new technologies; 2) the credit worthiness of individual borrowers; and 3) the changing forces in financial markets that affect the cost and availability of financial capital. To briefly review these factors, the financing characteristics suggest that most of the new technologies largely

should be financed with short and intermediate term loans that are part of the normal financing procedures for agricultural businesses. That is, the basic criteria of structuring loans to match loan maturities with anticipated payoff periods and to provide adequate loan security should not change in any fundamental ways, although the risks associated with obsolescence and collateral values will need careful consideration. However, the technical characteristics of the technologies, together with the factors comprising the credit worthiness of individual borrowers, suggest that much greater emphasis in credit evaluations will be placed on the management capacity of the agricultural production units, on their ability to demonstrate appropriate technical competence in using the new technologies, and on building human capital where appropriate. This is consistent with the more conservative responses by lenders to the agricultural stress conditions of the early 1980s. In turn, the lending institutions themselves must have sufficient technical knowledge and expertise to evaluate these management and credit factors, along with the other sources of business and financial risks in agriculture. Finally, some forms of new technology involving large investments and having long run uncertain returns will likely rely more on venture (equity) capital for financing.

The changing regulatory and competitive forces in financial markets, including the preference for greater privatization of some credit institutions, means that the cost of borrowing for agricultural producers will likely remain higher and more volatile than in pre-1980 times and will follow market interest rates much more closely. Similarly, the continued geographic liberalization of banking and the emergence of more complex financial systems mean that the functions of marketing financial services, loan servicing, and credit decisions

will become more distinct with an increasing proportion of credit control and loan authority occurring in sub-regional and regional money centers that are located away from the rural areas. This will continue to fragment and dichotomize the farm credit market so that commercial scale agricultural borrowers are treated as part of a financial institution's commercial lending activities (although separate personnel for agricultural and commercial loans should still be prevalent) and smaller, part-time farmers are treated as part of consumer lending programs.

The competitive pressures on financial institutions and the risks involved will bring more emphasis on analyzing the profitability of various banking functions, including loan performance at the department level and individual customer level. Innovative lenders will strive more vigorously to differentiate their loan products and financial services, especially for more profitable borrowers, and will more precisely tailor financing programs to the specific needs of credit worthy borrowers. In turn, however, these agricultural borrowers must be highly skilled in the technical aspects of agricultural production and marketing as well as in financial accounting, management, and risk analysis as they compete for credit services.

In light of the factors summarized above and their relationships to new technologies, the following sections consider the structural implications for agricultural production units. These implications are considered in five areas: size structure, market structure, financial structure, tenure structure, and legal structure.

Size Structure of Agricultural Production Units

For the size structure of agriculture, the capability and interest of commercial lenders in financing larger, soundly managed production units will

continue to increase. This in part reflects the anticipated movement toward larger banking systems as well as toward larger independent banks that will remain active in rural credit markets. Lending capacities are increasing due to greater legal lending limits, and larger, more stable funding bases. Risk bearing capacities in financial institutions are also increasing from the larger sizes and expanded geographic scope of these institutions, and from greater diversity in lending activities. These factors will encourage individual banks and banking systems to seek the business of larger farm units and agribusinesses that are considered the more profitable borrowing customers. Greater efficiency and cost control in customer relationships will be sought with large loan volumes continuing to play a key role in lending efficiency.

As banking systems become more complex, they will continue to develop and use various types of loan participation and joint financing arrangements among banks, although these arrangements will be more in response to competitive and risk factors for the lenders involved, and less in response to regulations. These arrangements may resemble, yet go beyond, the traditional correspondent participations, especially in multiple bank ventures in which complete and uniform procedures for loan documentation, credit analysis, and loan servicing are required. A shift may occur toward greater origination of loan participations by larger banks with participations sold to smaller banks rather than the reverse as in the past. In turn, these joint financing arrangements will be oriented toward larger sizes of agricultural production units that can effectively meet the necessary requirements in financial management.

As the Farm Credit System continues to evolve into a full service, united, competitive, commercial financial institution, it is natural for its banks and associations to gravitate toward the financing of larger, well managed farm

businesses. Moreover, if the agency status of the system's securities is eventually removed so that investors regard them as comparable to corporate securities, then the System will give even more attention to the risk characteristics of its borrowers and the quality of loan portfolios. This will make it more difficult for less credit-worthy borrowers (those who are younger, beginning or operating small, part-time farms) to obtain financing. While the FCS has a program for financing "young, beginning, and small farmers," this is in part attributed to the Farm Credit Act Amendments of 1980 in which Congress directed the district banks of the FCS to develop guidelines on a program to aid "credit-worthy, young, beginning, and small farms." Without this Congressional mandate, the System would have much much less incentive to provide such a program.

In general, then, the size-related preferences of commercial lenders, as expressed through lower interest rates, greatr credit availability, easier security requirements, and so on, will combine with other advantages larger farm businesses have in marketing, risk bearing, and information systems to continue the trend toward a bi-model distribution of farm sizes with greater concentrations of business activity occurring in the larger sizes of farms. These factors combined with reasonable profit prospects on farm assets should keep the trend in motion. If, however, profit prospects do not improve from early 1980 levels, then agricultural credit conditions will become less favorable, and the trend toward larger farm sizes and greater concentration of economic activity could be reversed.

Market Structure of Agricultural Production Units

For market structure in agriculture, the evolution of the financial system toward larger scale, more open financial markets will put more emphasis on a

systems approach to financing agriculture. The systems approach involves the vertical linkages and degrees of coordination that occur among the various stages of the food and fiber system. The linkages and coordination may vary from completely open markets with prices established for commodities at each stage of the system to a vertically integrated system in which the successive stages are combined into one decision making unit. The degree and type of vertical coordination vary greatly within agriculture (Sporleder). Nearly all dairy production and most commercial fruit and vegetable production in the U.S. operate under some form of market contract. The poultry industry generally and broiler production in particular have moved strongly toward vertical integration. The last decade has witnessed substantial vertical coordination in the beef industry. More recently, the swine industry has experienced similar developments, and even cash grain production has moved away from its strong emphasis on open markets toward greater use of forward contracts by farmers.

From the lender's standpoint, the systems approach makes financing less risky, more efficient, easier to control, and more profitable. The systems approach to agricultural financing has been especially common in large money center banks, especially those on the West Coast, and in some regional banks. As these types of banks and related banking systems continue to develop national lending markets and engage in joint financing of larger agricultural units, the systems approach to credit analysis and financing will become more prominent. Thus, agricultural borrowers will be commonly expected to consider the combined effects of production, capital investments and marketing in their financial planning, and to have marketing plans that are soundly developed in

terms of the types of marketing practices typically followed for the various commodities. The systems approach does not necessarily imply a movement toward greater market coordination, although this will likely occur for many commodities. The systems approach does, however, imply greater attention by borrowers to the marketing component of their management activities.

The systems approach does not represent a new approach to agricultural financing of financial planning. Indeed, farm lenders have shown growing interest in improving farmers' marketing policies in order to reduce lending lending risks and improve management ability. In response, the awareness and use of forward contracting, hedging, spreading sales, and monitoring market information have been on the increase, although farmers' skills in these areas are still considered in an early stage of development. Looking to the future, however, the greater emphasis by financial institutions on a systems approach to financing agriculture essentially means that the marketing skills must move significantly from the "idea" or "development" stage into a mature status in business planning with rigorous, yet routine use for the various commodities involved. In turn, these developments will likely lead to greater degrees of market coordination for most commodities, and thus change the market structure of agriculture.

Financial Structure of Agricultural Production Units

The financial structure of many agricultural units has come under growing pressure in the 1980s due to the combined effects of high indebtedness, high interest rates, low returns to farm assets, and lower values of farm land and other assets. These factors have pushed up financial leverage, reduced liquidity, and created a highly fragile financial situation in agriculture. As census data and surveys have shown, most of the farm debt is concentrated in larger farm operations, among younger farmers, and in part owner operations. Under the greatest stress are those farmers whose debt to asset ratios have have increased above .40. These farmers comprised nearly 20 percent of the total U.S. farms in 1984, but due to their larger sizes they comprise a much larger portion of the commercial scale producers and hold a relatively large portion (about 63 percent) of total farm debt. Thus, it appears that about one-third of the commercial scale producers had leverage positions that were high enough in 1984 to cause substantial financial distress (Melichar). Moreover, about 5 to 10 percent of farmers have debt to asset ratios exceeding 70 percent; these are in the most vulnerable position. In contrast, however, another one-third of these commercial producers have little or no debt.

These farm credit problems of the mid-1980s constitute an important issue in agricultural finance and policy. These conditions also hamper a longer term assessment of farmers' financial responses to the regulatory and competitive changes affecting financial institutions. In the near term, it is clear that part of the effects of financial deregulation (higher, more volatile interest rates) and the related responses of financial institutions (e.g. floating loan rates) have contributed to the increased leverage and financial vulnerability of these commercial scale producers. Over the longer term, however, the

financial structure issue in agriculture rests heavily on the balance between 1) the levels and variabilities of returns to assets for agricultural production units with different structural characteristics, and 2) the levels and variabilities of interest rates and other costs of financial capital.

If the levels and volatility of borrowing costs remain higher as a result of financial deregulation, relative to anticipated returns to farm assets, then agricultural borrowers must eventually reduce the financial leverage in their operations, or seek other methods of responding to the higher financial risk. Between these two choices, the leverage response will likey be greater, especially for those farms under greater financial stress. Lenders in general prefer levels of farm debt that can be serviced with reasonable confidence from from projected cash flows; in the absence of sharp increases in farm revenues, this preference means lower leverage relative to current levels.

Other leverage pressures are arising from the recent declines in land values that have reduced equity levels, diminished long term credit reserves, eroded refinancing capacity, and brought greater uncertainties about future changes in land values. The importance of liquid assets in the overall asset structure of agricultural production units will likely increase as well due to slower expansion of farm businesses, greater emphasis on asset diversity, and slower growth of land values relative to historic trends. Thus, fundamental long term changes in the financial structure of agriculture will occur as a result of the higher costs and wider swings of interest rates in financial markets.

The future may also bring changes in farmers' use of various sources of credit, although this will depend on the evolving competitive and structural characteristics of financial institutions. For commercial banks, the greater lending competition among larger banks and banking systems along with a shift of final credit decisions away from rural communities may make agricultural borrowers more sensitive to changes in interest rates and other financing terms. The traditionally strong lender-borrower relationship at the local level may diminish with more shopping for credit occurring especially among small and medium size farms. An offsetting factor however, could be the growing competition by larger banks for the more profitable agricultural customers through bank marketing practices and personalized services. The ability of commercial banks to develop stable, cost-competitive sources of long term credit, will also stabilize their relationship with the more profitable borrowers.

The mix of credit sources could also differ for borrowers from the Farm Credit System in light of the System's trend toward common market areas and management between Federal Land Bank Associations (FLBA) and Production Credit Associations (PCA). The same loan officer serving the full range of short, intermediate, and long term loans may encourage more borrowers to obtain complete financing from FCS, compared to split financing of the past in which the same borrower would utilize FLBs for long term lending and perhaps commercial banks (and other sources) for short and intermediate term loans.

The future may also bring greater diversity in the equity capital structure of agriculture with continued efforts to develop channels for

attracting outside equity capital, at least for some types of agricultural production units. For the traditional owner-operator farm unit, the major sources of equity capital have been retained farm earnings, capital gains especially on farm land, off farm earnings, and gifts and inheritances from other family members. Over time, however, intergeneration transfers have dispersed the ownership of farm land so that off-farm landlords and other individuals have become significant equity claimants., Moreover, some sub-sectors of agriculture (cattle feeding, cattle breeding, citrus and vineyard) have departed substantially from the small business, family orientation by placing considerable reliance on outside equity capital. In some cases, the equity investments have responded to tax considerations and short-term profit prospects. Considerable instability in this type of funding may occur if capital is withdrawn for reinvestment elsewhere due to changes in tax laws, profit prospects, or other factors.

In the future, key issues associated with outside equity involve the public attitude toward this funding source and the needs for new funding methods. Much of the need for outside equity is based on the dual effects of: 1) providing additional financial capital to acquire high cost capital items (including some types of new technologies) and accelerate business growth, and 2) spreading the business and financial risks of agricultural production over a deeper equity base and a more diverse set of investors. It is unlikely that either of these needs for equity capital will diminish, although the future pressures for funds needed to acquire capital items may lessen compared to the past. However, for younger new entrants to farming the costs of establishng and operating farm businesses will continue to be high, and business and

financial risks will remain relatively high. In addition, the greater sophistication in management for utilizing new technologies may also lead to greater separation and specialization in the financing, ownership, and management functions. Thus, the regulatory and competitive conditions affecting farm credit markets, combined with the managerial requirements of new technologies will continue to stimulate financing innovations that essentially involve outside equity entering traditional agriculture. This will yield greater dispersion in financial claims on farm assets and clearer delineations among ownership, financing, management, and labor. In the past public attitudes and policies
have discouraged the flow of outside equity capital into agriculture through formal mechanisms especially involving farm land. These conditions may change in the future as well.

Tenure Structure of Agricultural Businesses

Leasing has been a primary method of financing the control of farm land by farm operators, and is increasing as a means of financing for non-real estate assets. In general, leasing of any asset is a form of financial leveraging since the lease creates a fixed financial obligation (rent) for the lessee as well as a valuable asset in the lease contract. Within this framework, leases may exhibit a variety of characteristics for pricing, maintenance and cost responsibilities, length, etc. In many cases, tax considerations may strongly influence the leasing terms, while market forces, custom in the local area, a economic conditions of the leasing parties are also important.

The leasing market for farm land has two unique characteristics: 1) the variety of pricing arrangements, as in the cases of share rents and flexible

cash rents, that spread agricultural business risks between the lessee and lessor (in contrast to the fixed payment commitments in debt financing), and 2) the long standing custom for many leases to be short-term (e.g. one year) and for continued reliance in some cases on oral rather than written agreements. These characteristics make share leasing of farm land highly favored as a risk management technique, although the relatively short term of many leasing contracts is a source of instability in resource control.

Leasing arrangements for non-real estate assets include the traditional custom operation, short-term operating leases, and longer term non-cancellable financial leases. Most of the interest has been on financial leases, although their use in production agriculture has been much less than in other economic sectors. From the farmer's standpoint, the low use of leasing reflects the tendency for financial leases to be a higher cost, after-tax form of financing than ownership. However, there has been growing interest by financial institutions in offering financial leases to farmers at lower costs than intermediate term loans. The financial institutions can do this through the tax savings they realize from owning the leased assets. These developments suggest that financial leasing should continue to develop into a routine financing method that is favored by some agricultural producers and not others, and the use of which will vary with tax and other economic factors.

In looking to the future and considering the changing regulatory and competitive environment of financial institutions, it is likely that longer term leasing likely will become a more commonly used form of financing in agriculture. Compared to smaller banks, larger banks and banking systems are

more accustomed to offering leasing services along with credit and other financial services to their customers. In addition, the Farm Credit System has made significant progress in offering financial leases to their customers, and many merchants and dealers also offer leasing arrangements. Thus, it appears that financial leases of nonreal estate farm assets will increase in the future.

It is more difficult to project whether leasing of farm land will increase, since it is already extensive; however, significant changes in the characteristics of leasing may occur. For example, in the future farm lenders and other financial institutions will be less concerned with the method of resource control (ownership, lease), and more concerned with the stability and cost of resource control. While land will always be highly desired as collateral, financial institutions will be increasingly responsive to leasing contracts that assure the asset's availability and use for reasonably long periods of time. Similarly, financial plans by agricultural producers that document the cost advantages of leasing will become more important, as will the producers' skills in managing leasing arrangements with multiple landlords and other lessors. Along with the stabilizing features of leasing contracts may come other ways of adding liquidity to leasing arrangements. Secondary markets, for example, for financial and real estate leases could develop to facilitate lease transfers among lessees. And, insurance and loan guarantees provided by public credit programs could be extended to leases to reflect the financing similarities of leasing and borrowing.

In general, the tenure and ownership structure of agriculture will experience institutional innovation in which packaging of debt and equity financing, leasing, management, accounting, and legal services will continue to evolve. This will parallel the growing requirements for management ability and human capital associated with new technologies. It will also be linked closely to other structural characteristics of agricuture, as discussed in the preceding sections, in which farm size, marketing systems, leverage, and outside equity are involved.

Legal Structure of Agricultural Production Units

The legal structure of agricultural businesses has been heavily dominated by single proprietorships, although various forms of partnerships and corporations have become more common. The latter have emerged as means of facilitating the management of assets within and between farm families, as well as in response to income tax obligations and inter-generational transfers. In general, as the structural characteristics of farm businesses become more complex, agricultural investors, including outside investors, prefer investment channels that clearly delineate among ownership, management and labor, that involve fractional or share claims on assets rather than outright ownership, and that limit the investor's financial liability.

Establishing definitive relationships between the legal structure of farm and financial market forces is quite tenuous, since most of the legal responses are due to other factors. Nonetheless, as the channels for bringing outside financial capital into agriculture become more diverse, so should the legal organizations of agricultural businesses. Moreover, as the lending competition in agriculture increases with more financing from larger, more concentrated financial systems, the legal form of business organization will evolve away from the single proprietorship form. In general, however, the resulting organizational changes should be more in response to other structural forces, and less in response to changes in financial markets.

Summary and Conclusions

This paper has considered the relationships among technology adoption, financing consequences, and the structure of agriculture. The major financing focus is on the credit component of financial capital, and how the regulatory and competitive changes of U.S. financial markets during the 1980s will influence the cost, availability, and other terms of credit for agricultural producers, and the consequences for structural change. Virtually all of the major farm lenders have experienced significant changes in their competitive and regulatory environment. The decontrol of interest rates has directly affected commercial banks, along with continuing changes in the geographic scope of banking and the range of products and services banks can offer. The Cooperative Farm Credit System has been significantly affected by the financial stresses of agriculture in the 1980s and has experienced much debate about the agency status of its securities and its role as a specialized lending institution for agriculture. The Farmers Home Administration and other public credit programs have also experienced changes in regulations and lending authorizations, and continuing concerns about the stresses of farm credit problems and high tax payer costs.

In looking to the future and the issues affecting technology adoption, the financing consequences of new technologies in agricultural production will likely depend on the relationships among three important factors: 1) the financing characteristics of the new technologies; 2) the credit worthiness of individual borrowers; and 3) the changing forces in financial markets. The financing characteristics suggest that most of the new

technologies should be financed with short and intermediate term loans that are part of the normal financing procedures for agricultural production units. That is, the basic criteria of structuring loans to match loan maturities with anticipated payoff periods and to provide adequate loan security should not change in any fundamental ways, although the risk associated with technological obsolesence and collateral values will need careful consideration. However, the technical characteristics of the technologies, together with the factors comprising the credit worthiness of individual borrowers, suggest that greater emphasis in credit evaluations will be placed on the management capacity of the agricultural production units, and on their ability to demonstrate appropriate technical competence in using the new technologies. In some cases significant investments in human capital with related financing requirements may accompany the adoption and use of new technologies. In addition, some forms some forms of new technology involving large capital investments and having uncertain long run returns likely will rely more on venture (equity) capital for financing.

The changing regulatory and competitive forces in financial markets, including greater privatization of the credit function, means that the cost of borrowing for agricultural producers will remain higher and more volatile than in pre-1980 times. The continued geographic liberalization of banking and the emergence of more complex financial systems will induce competitive efforts by lenders to segment financial markets and will shift an increasing proportion of credit control and loan authority toward sub-regional and regional money centers. This will continue to fragment and dichotomize the farm credit market so that commercial scale agricultural borrowers are

treated as part of a lender's commercial lending program and smaller, part-time farmers are considered in consumer lending programs.

The competitive pressures on financial institutions and the risk involved will bring more emphasis on analyzing the profitability of lending activities and other banking functions. Innovative lenders will strive more vigorously to differentiate their loan products and financial services, especially for more profitable borrowers, and will cater more to the specific needs of credit worthy borrowers. In turn, however, these agricultural borrowers must be highly skilled in the technical aspects of agricultural production and marketing as well as in financial accounting, management, and risk analysis as they compete for credit services.

In general, most forms of new technology in agricultural production should meet the tests of both economic and financial feasibility, although the structural characteristics of the adopting farm units will continue to evolve in response to managerial, economic, and financial market factors. The structural consequences of these factors are several fold: 1) a continuing push toward larger sizes of commercial scale farm businesses with greater skills in all aspects of business management; 2) continuing evolution in the methods of entry by young or new farmers into agriculture with greater emphasis on management skills and resource control, and less emphasis on land ownership; 3) a marketing systems approach toward financing agriculture will continue to develop, with more sophisticated skills in

marketing analysis by farmers and higher degrees of coordination with commodity and resource markets; 4) more formal management of financial leverage and credit by farmers with greater diversity of funding sources by individual farm units and better developed markets for obtaining outside equity capital; 5) further development in financial leasing and greater stability in leasing arrangements for real estate and nonreal estate assets; and 6) more complex business arrangements in production agriculture that accommodate various ways to effectively package debt and equity financing, leasing, management, accounting, and legal services for the farm business of the future.

These trends will differ in magnitude and intensity among various types of farms and in some cases may encounter social resistance due to traditional preferences for the historic structure of agriculture. But the basic movements in these directions have been underway for a long period of time, and the regulatory and competitive changes that are projected for financial institutions appear consistent with them.

References

Barry, P.J. "Impacts of Regulatory Change on Financial Markets for Agriculture." American Journal of Agr. Economics 63(1981):905-912.

Barry, P.J. Impacts of Financial Stress and Regulatory Forces on Financial Markets for Agriculture: Current Directions and Policy Issues. Food and Agriculture Committee, National Planning Association, Washington, D.C. 1984

Farm Credit Administration, Risk and the Structure of Agriculture, Washington, D.C. 1980.

Lee, J., S. Gabriel, and M. Boehlje. "Public Policy Toward Agricultural Credit." Future Sources of Loanable Funds for Agricultural Banks. Federal Reserve Bank of Kansas City, 1980

Lins, D.A., and P.J. Barry. "Availability of Financial Capital as a Factor of Structural Changes in the U.S. Farm Production Sector." Farm Structure, Committee on Agriculture, Nutrition, and Forestry, U.S. Senate, Washington, D.C. 1980.

Lins, D.A. and P.J. Barry. "Agency Status for the Farm Credit System." American Journal of Agricultural Economics 66(1984):forthcoming.

Lowenberg-DeBoer, J. and M. Boehlje. "Evaluation of State Legislative Programs to Assist Beginning Farmers." Agricultural Finance Review, Vol. 43, 1983, p. 9-20.

Sporleder, T. "Emerging Information Technologies and Agricultural Structure." American Journal of Agricultural Economics 65(1983):388-394/

U.S. Department of Agriculture, A Time to Choose. Economic Research Service, Washington, D.C. 1980.

Background Paper No. 5

The Role of Federal Credit Assistance Programs in the Process of Technological Change

David Trechter and Ronald Meekhof
U.S. Department of Agriculture

August 1985

Office of Technology Assessment
U.S. Congress

This background paper was prepared for the assessment "Technology, Public Policy, and the Changing Structure of American Agriculture." The views expressed are those of the author(s) and not necessarily those of OTA.

The Role of Federal Credit Assistance Programs in the Process of Technological Change

David Trechter and Ronald Meekhof

Agriculture has been major recipient of federal credit assistance. A policy of enhancing farmers' access to credit was initiated in the early 1900s and given greater emphasis during the Great Depression. The objectives of these policies have been to overcome imperfections in existing agricultural capital markets and to address the problems of poverty, tenancy, and economic development in rural areas. The institution which, over the years, has been most directly involved in this effort is the Farmers Home Administration and its predecessor agencies.[1] Public credit institutions have had a substantial impact on farming and economic development in rural areas. Generally, farmers now have reliable access to credit at terms that reflect the unique characteristics and risks of the agricultural production process. The technological revolution and capital restructuring that have taken place in agriculture since the 1930s were facilitated by improved capital markets.

The changes wrought by the technological advance of agriculture during the past half century are familiar to most people. Farm employment and farm numbers have decreased, and average farm size has increased in response to the adoption of more capital intensive technologies. Farms have become more specialized, more dependent

1. Other public agencies such as the Small Business Administration and quasi-public agencies such as the Farm Credit System have been involved in this effort. They will not be discussed in this paper since in the case of the former their efforts have tended to be sporatic and not of substantial magnitude and in the case of the latter are now largely private in nature.

upon purchased inputs and farm income has approached the level of the nonfarm population.

This paper examines the role federal credit might play in the ongoing process of technological change in agriculture. The rationale for, types of, and magnitude of federal credit assistance programs is reviewed. The process of technological change is examined and important institutional changes that have occurred in the system are noted. Out of this grows a discussion of the innovations that are expected to affect agriculture over the next 15 years, capital and other constraints to adoption, and the sort of farms most likely to be adoptors. A profile of farmers most likely to adopt new technologies is compared to those served by FmHA. Finally, options which might allow FmHA to play a more vital role in the process of technological change are discussed.

The Rationale for Federal Credit Programs

Justification for direct federal involvement in farm credit is generally based on two premises. The first is that a well-functioning credit market will not always achieve chosen social priorities and objectives. Hence, the public intervenes and redirects financial resources to offset conditions resulting from natural disasters, or to provide preferential treatment to certain groups, regions, or sectors of the economy. The second premise is that imperfections in credit markets may constitute a credit gap. Distortions in the demand for loanable funds caused by nonmarket forces may also affect the availability of funds to a region or sector. Throughout the history of public agricultural credit programs, social and market performance objectives have been intertwined.

Social Objectives

It is unlikely that a federal credit program would be organized to rectify market failures unless important national objectives were not being met. By reducing the cost of credit and increasing its availability, agricultural credit policies attempt to redistribute loanable funds in the sector. The original goals of agricultural credit policies were to stimulate productivity through more efficient use of resources, broaden ownership of land, provide for stable economic growth, and ease the major social crisis caused by economic hardships during the post-World War I and Great Depression periods.

Credit Gap

A credit gap implies that investment opportunities exist for which benefits (returns) exceed the cost (interest rate) after adjusting for risk, and those investment opportunities do not attract funds because of artificial barriers. Artificial barriers may result from legal and institutional restrictions, inadequate information, prejudice, habit or tradition.

The public may benefit when the government takes steps to remedy a credit gap. However, direct government lending and actions of government-sponsored agencies are not neutral since they divert funds from other sectors of the economy. Even when loan guarantees are provided, the supply-demand balances in the various sectors of the capital market are altered, affecting interest rates and the allocation of resources in the rest of the economy (McKie). However, if a credit gap distorts the flow of loanable funds from the socially optimal pattern, reducing the gap may improve the allocation of resources.

In theory, interest rates ration funds among competing uses.

Each borrower's williness to pay for these funds depends on the expected profitability of the activity to which those funds are to be applied. Differences in interest rates will exist in well-functioning financial markets because of differences in risk associated with various activities, in the cost of providing funds to various borrowers, and other factors. Therefore, simply because a potential borrower is willing and able to pay the rate at which credit is offered, yet is unable to obtain the loan, does not, per se, indicate a credit gap.

Available evidence suggests that there was a credit gap facing agriculture prior to the development of federal programs in the early 1900s. Farmers' access to credit had been a long-standing problem in the U.S. Farm mortgages carried high rates of interest and frequently had maturities of less than 3 years (Bogue). There were large regional interest rate differentials—interest rates in the South and West were very high compared to those in regions closer to national money markets—although a substantial portion of these differences could have reflected cost and risk factors (Johnson). Isolation from national financial markets in earlier time periods is also cited as a cause for major fluctuations in credit availability for some agricultural regions (Johnson). Interestingly, several authors have noted that one impact of the structural changes taking place in banking as a result of deregulation is closer ties between agricultural and national financial markets (Barry, Lins). Many feel this will result in greater fluctuations in the terms of agricultural loans while stabilizing credit availability (Project 1995, Barry).

Types of Federal Credit Policies

Federal credit programs can take one of two basic forms. Either the government can make loans directly to the party it seeks to assist or it can encourage private sector lenders to grant credit by offering them loan guarantees.

Direct Loans

Federal agencies make direct loans in order to channel economic resources to particular uses. The use of a direct loan is justifiable when a social objective could not be achieved through private sources of credit, even if loan guarantees were made available. In order to ensure that the objectives of the loan program are achieved, credit may be provided at rates that are below commercial rates and often at longer maturities. The federal agency services the loan and may also provide technical assistance.

Guaranteed Loans

Loan guarantees are generally provided when, even though commercial lending institutions are well-developed, the government deems it necessary to provide incentives to stimulate some set of economic activities. Under a loan guarantee, the government promises to pay all or part of the principal and interest on loans made by private lenders in the event of default. The guaranteed obligation may also be a security sold in the capital market or to the Federal Financing Bank.

A loan guarantee transfers some or all of the risk to the government and in effect transforms the private loan into a near-government direct loan which may be financed by a near-government security. As a result, interest rates on guaranteed loans are often lower than regular commercial loans.

The Farmers Home Administration

To many, federal credit assistance for agriculture is synonomous with the Farmers Home Administration. For forty-eight years FmHA and its predessor agencies have been the lender of last resort for farmers. The agency now serves a far broader mission than it did initially. FmHA has programs for housing and community development in addition to those for farming. These programs are carried out through direct loans to farmers and, to a lesser extent, by government loan guarantees.

Farmer Programs of FmHA

The most important of the farmer programs in terms of volume of obligations are the Operating (OL), Farm Ownership (FO), and Emergency Disaster (ED) loan programs with 44, 24, and 15 percent of farmer program obligations in fiscal year 1984, respectively.[2] A high proportion of loans to farmers under these categories are made directly by FmHA at concessionary interest rates and maturities. Other programs include the Economic Emergency, Soil and Water, Recreation, and Irrigation and Drainage.

The FO program was designed to enable beginning and tenant farmers to become owner-operators. Loans can also be used to refinance existing debt, develop water resources, finance a variety of nonfarm enterprises, and purchase, improve, or enlarge farms. The FO loan program's share of annual farmer program obligations increased from 16 percent in 1960 to 41 percent in 1970, but declined to 24 percent in fiscal year 1984. Its share of total farmer program loans outstanding was 28 percent as of March 31, 1985.

---

2. Data reported in this section are drawn from FmHA reports 616 and 205, various years.

Table 1—Farmers Home Administration, Loans and Grants Obligated(a)

Fiscal Year	Program				
	Operating Loan	Farm Ownership	Emergency Disaster	Other	Total
	Millions				
1975	550.8	351.6	735.0	371.1	2,008.5
1976	539.2	435.0	447.7	777.8	2,199.7
1977	542.3	451.2	1,178.4	256.1	2,428.1
1978	780.6	550.8	3,411.8	252.6	4,995.9
1979	894.8	763.2	2,871.6	3,175.9(b)	7,705.5
1980	874.8	954.1	2,266.9	2,247.5(b)	6,349.3
1981	847.6	813.3	5,112.3	1,307.4(b)	8,073.8
1982	1,251.0	661.6	2,173.4	27.8	4,113.9
1983	1,735.5	749.5	565.9	19.7	3,070.7
1984	2,071.4	700.7	1,052.0	614.5(b)	4,458.7

(a) Data are from FmHA report number 205, various years.
(b) Includes Economic Emergency loans.

Table 2—Farmers Home Administration, Loans Outstanding, January 1,(a)

Year	Program				
	Operating Loan	Farm Ownership	Emergency Disaster	Other	Total
	Millions				
1975	923.6	2,644.6	109.8	235.9	3,913.8
1976	1,023.4	2,821.2	744.1	243.8	4,832.5
1977	1,033.6	3,040.1	842.2	297.6	5,213.5
1978	1,077.5	3,300.4	2,067.0	364.1	6,809.1
1979	1,487.5	3,609.7	4,299.6	412.6	9,809.4
1980	1,600.0	4,280.9	6,104.4	3,704.1(b)	15,689.3
1981	1,854.4	4,876.0	7,316.1	5,028.8(b)	19,075.4
1982	2,058.2	5,374.8	9,981.3	5,412.5(b)	22,826.7
1983	2,499.3	5,852.7	10,029.8	5,057.1(b)	23,438.9
1984	3,050.4	6,408.6	9,482.0	4,551.8(b)	23,492.8

(a) Data are from FmHA report number 616, various years.
(b) Includes Economic Emergency loans.

The OL program provides short and intermediate-term loans to family farmers for a variety of purposes including the purchase of livestock, farm supplies, food and clothing, as well as for the purchase or construction of nonfarm enterprises. The OL program's share of total farmer program obligations declined from 74 percent in 1960 to 14 percent in 1980, but has since rebounded to more than 46 percent. More than $3 billion had been obligated under this program during the first eight months of fiscal year 1985. Since these loans are short term instruments, the OL program constitutes only 10 percent of all farmer program loans outstanding.

ED loans were designed to help farmers overcome the impact of natural disasters. To be eligible for an ED loan the farm must be located within a region which is declared a disaster area. Some funds can be obtained from the ED program at concessionary rates (if used to replace assets lost in the disaster), and additional funds at market rates of interest. Funds obtained from this program may be used to reconstruct buildings, purchase farm supplies or refinance other debts. Tables 1 and 2 indicate that this program grew rapidly from 1975 until 1981 and continues to be a major program.

FmHA Credit Terms

Prior to 1978, interest rates charged by FmHA on farmer program loans did not reflect the government's cost of funds. Interest rates on FmHA loans for real estate purchases were fixed at 5 percent in nominal terms and were substantially less than rates charged by lenders such as the Federal Land Bank. Since 1978, rates paid for FmHA real estate loans have reflected the government's cost of funds more accurately and have been similar to Farm Credit System rates. This is illustrated in the top panel of Figure 1.

In the lower panel of Figure 1 the interest rates charged by FmHA and rural banks for non real estate loans are compared. The figure shows that for comparable loans, FmHA non real estate interest rates were consistently lower than rates charged by rural banks during the 1970s and 1980s.

Changes_in_FmHA's_Operations

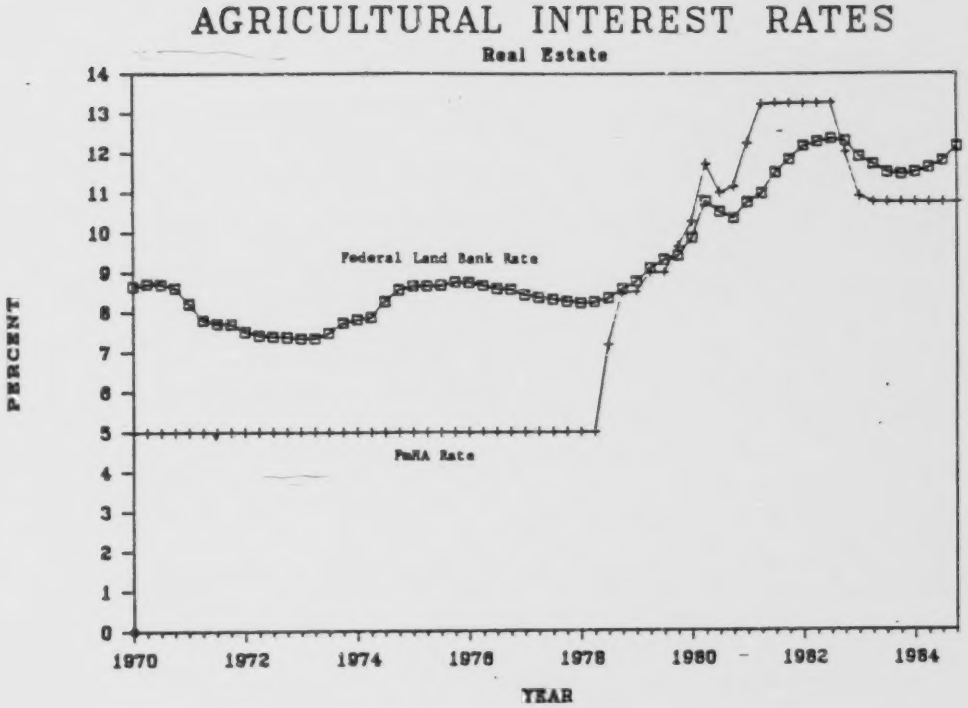
Over the years FmHA's role has expanded greatly. The agency's initial mandate was to facilitate the entry of young people into farming and to assist those with limited resourses. It is now simply the lender of last resort. Subsistence and large scale operations are both eligible for loans from FmHA if they are unable to obtain credit elsewhere. Several changes in the rules under which FmHA operates have made this expanded role possible. Among the more important changes were: an increase in the maximum loan size, authorization to refinance existing indebtedness, authority to make loans to part-time farmers, and development of loan guarantees. Economic factors and structural changes within the sector have contributed to changes in FmHA operations (Hathaway).

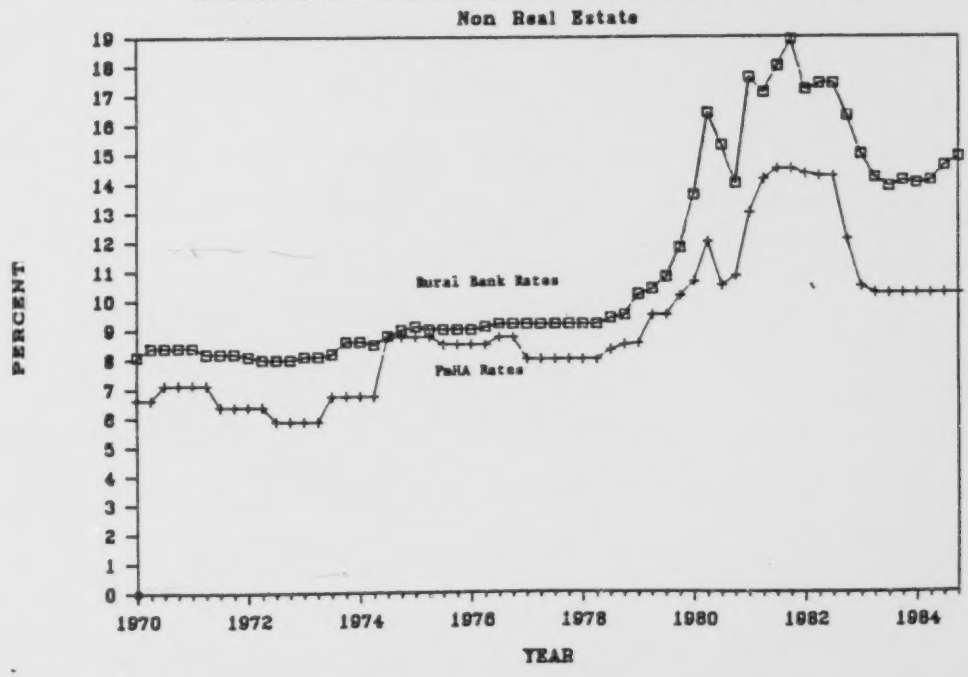
Federal credit assistance has evolved to meet the changing needs of its clientele. In the next section of this paper, factors associated with the process of technological change which are likely to call forth additional institutional changes in FmHA are identified.

Technological_Change_in_Agriculture

The process of technological change has received a great deal of attention in the professional journals, especially those of rural sociologists and agricultural economists. If technological change is

Figure 1


AGRICULTURAL INTEREST RATES
Real Estate
Federal Land Bank Rate
FmHA Rate
PERCENT
YEAR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
1970
1972
1974
1976
1978
1980
1982
1984


AGRICULTURAL INTEREST RATES
Non Real Estate
Rural Bank Rates
FmHA Rates
PERCENT
YEAR
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
1970
1972
1974
1976
1978
1980
1982
1984

considered in terms of a market, most of the debate has focused on factors of demand. To appreciate the role PmHA may play in the ongoing process of technological change, it is important to understand both the supply and demand sides of this market. It will be argued that the past fifteen years have witnessed an important change in the supply of innovations which will alter the roles played by different credit sources. In addition, the specific constraints upon demand for new technologies must be examined to appreciate the market niche PmHA might fill.

The Supply of New Technologies

Major changes have recently taken place in the relative importance of the institutions involved in the supply of new agricultural technologies. In particular, the institutions which generate practical agricultural applications from advances in biology have become predominantly private.

Technological advance in American agriculture can be seen as successive waves dominated by a particular class of inventions. The first wave featured mechanical technologies such as the McCormick reaper, the cotton gin, tractors and so on. The second wave, which began in the 1930s, featured hybrid seeds and agricultural chemicals. Both of these waves of change were facilitated by a patent system, which provided an economic incentive to those with an inventive mind and a mechanical or chemical bent. In both cases, private institutions such as John Deere and Pioneer Seeds dominated the innovation and diffusion processes.

A third wave of technological advance in agriculture is now beginning. This phase will be dominated by biological and information sciences. It is argued that private firms will take the lead in

research and extension efforts in this wave as they did in the mechanical and chemical phases. Because private sector researcher/entrepreneurs will dominate the process, the mix of products and the target groups will be different than if public researchers had been the driving force. The imperatives of the marketplace will channel the efforts of private sector researchers into areas with readily identifiable commercial applications. The marketing efforts these firms will almost certainly mount to sell their innovations, will be directed at larger commercial farms by the same market forces.

Public sector researchers historically have played an important role in the development and extension of many agricultural innovations, particularly in the biological sciences. Prior to 1930, patent protection was not available for biological inventions. It was simply too difficult to enforce patent rights on processes which could be replicated with ease by many people. Hybridization changed this to a certain extent, but the niche covering sexually reproducing organisms remained outside the domain of patents. The U.S.D.A.-Land Grant University-Agricultural Experiment Station nexus was developed to fill this niche.

For a variety of reasons, the dominance of the public research system in biological processes has eroded during the past 15 years. Evenson points to the Plant Variety Protection Act (PVPA) of 1970 as a major factor in this change. The PVPA gives protection resembling that afforded by a patent to breeders of sexually reproduced materials. In Diamond versus Chakrabarty, the court found genetically engineered material to be patentable. As a result of these

developments, an economic incentive has been provided to biological scientists resulting in a more dominant role for private research organizations. Evenson illustrates this increased importance by noting that for every crop type, private research organizations have been granted more PVPA certificates than have public ones. Furthermore, Evenson notes that public agricultural research budgets have stagnated in recent years, while private funding has increased rapidly.

Evenson lists two other factors contributing to the decline of public research organizations. One is an increased separation of agricultural scientists from those who do the basic, theoretical research which underpins their applied work. A second factor is the increased politization of public research bodies, a factor which has affected public perceptions of these research efforts. The classic example of this is the involvement of the University of California at Davis with the development of the mechanical tomato harvester and the public uproar that ensued.

The result of these changes is, as stated by Bonnen, that the federal government "has already forfeited its unique research leadership role in setting national priorities, not only for basic research, but for an appropriate mix of applied research."[3]

The conclusion that larger commercial farms will be the major beneficiaries of the emerging technologies agrees with the assessment of a group of scientists assembled by the Office of Technology Assessment (OTA). These scientists developed a list of technical packages that they felt will have some impact on agriculture over the

---

3. Pg. 960, Bonnen, James, "Historical Sources of U.S. Agricultural Productivity: Implications for Research and Develeopment Policy and Social Science Research," Am. J. Agr. Econ., 65, 5, 1983.

next 15 years. In all but one case, these experts felt that larger farms will adopt the technologies with greater frequency than will smaller or medium sized farms. Therefore, on balance these new technologies are likely to contribute to the long-standing trend toward larger farms rather than reverse it.

The Demand for New Technologies

The economics of technological change in agriculture has elicited a good deal of debate. Cochrane has long promoted the idea that technological change has agriculture on a treadmill. New technologies are said to cause supply potential to outstrip demand so the initial economic advantage of increased yields or decreased unit costs is soon completely off-set by falling product prices. As a result, all of the economic advantages of a technological advance go to early adopters. Griliches explained the timing and speed of adoption of a new technology (hybrid corn) in terms of the economic returns associated with it.

Sociologists, such as Rogers, argue that a minimum level of profitability is required to initiate the adoption process but socio-economic factors govern the process thereafter. Rogers stresses such variables as the level of education, integration into the community and exposure to multiple sources of information in explaining the pattern of diffusion.

Another factor of importance in explaining the process is risk, both in terms of the riskiness of the new technology and the potential adopter's attitudes toward risk.[4] This paper focuses on the economic factors which affect the process of technological change.

---

4. See Chris O. Andrew and Jose Alvarez, "Adoption of Agricultural Technology: Developments in Agri-Socio-Economic Thought," Social & Economic Studies, 31, 3, 1982.

Insights into the demand for new technologies can be gained by considering some of the costs of adoption. Figure 2 provides a diagramatic way of classifying some of the technologies identified by OTA in terms of the financial and human capital costs of adoption. As can be seen by this array, many of the emerging technologies will require relatively modest amounts of capital to adopt. Many of these technologies focus on enhancing the productivity of inputs and will be adopted using operating capital. On the other hand, some of the technologies will require significant investments in human capital if

Figure 2: A Two-way Classification of Capital Requirements of New Agricultural Technologies

High Human Capital Cost	
Computers Biologic Pest and Disease Control Animal Nutrition Telecommunication	Robotics Environmental and Animal Behavior Automated Controllers
Low Capital Cost	High Capital Cost
Genetic Engineering Animal Reproduction Enhanced Photosynthetics Biologic Nitrogen Fixation	Multiple Cropping Sensors Crop Separation, Cleaning and Processing
	Low Human Capital Cost

they are to be successfully employed. In the literature dealing with technological adoption, innovations are frequently discussed in terms of their "congruence". Congruence indicates the degree to which a new technology is like an existing one. Hybrid corn looked like regular seed corn, was handled similarly and the output was similar (if in greater volume) and hence is said to have had good congruence. A home computer, on the other hand, is unlike any farm implement currently employed by most farmers and therefore lacks congruence. Lack of congruence typically implies a need for relatively greater investments in human capital if adoption is to occur.

The Profile of an Innovator

From the preceding discussion we conclude that the most likely farmer to adopt a new technology is one who has access to information about emerging technologies, has the economic and technical skills required to evaluate the innovation, has the capital (or access to credit) necessary to acquire and utilize the new technology effectively and early in the diffusion process, and has the inclination and ability to bear any increases in risk.

FmHA and Technological Change

The role FmHA will play in the continuing process of technological change will depend upon several factors. The first factor is the composition of FmHA's customers compared to the adopter profile discussed above. This could also be asked as, "Are the most likely adopters going to use public or private sources of credit?" Second, the economic environment prevailing in the agricultural sector will affect adoption rates and patterns. Finally, the specific technologies that emerge and the demands they put on a firm's capital

will influence the FmHA's contribution.

FmHA Borrower Profile

The characteristics of FmHA's borrowers will help determine the role the agency will play in the continuing process of technological advance in agriculture. The most complete breakdown of FmHA borrower characteristics is in U.S.D.A.'s National Agricultural Credit Study of 1981. The study's classifications are based on data from 1979 (for total value of property owned and total debt outstanding) and 1978 (for farm incomes and expenses). Economic conditions in agriculture are much different in 1985 than they were in 1978 and 1979. The changed economic conditions have, no doubt, changed some of the study's specific findings regarding borrowers' characteristics, though it would be somewhat surprising if the general pattern of results is greatly altered.

FmHA offers various types of loans to farmers and the profile of borrowers differs somewhat by loan category . The typical borrower from FmHA who receives an OL or a FO loan is, according to the National Agricultural Credit Study, a young farmer with few resources. A large majority of recipients of these types of loans had, in 1979, less than $50,000 in net worth, owned less than $80,000 in property, earned little off-farm income, had net farm income of less than $7,000 per year and had gross sales of under $10,000 per year.[5] Approximately half of the recipients were under thirty years of age and this group received about half of the funds disbursed under these two loan catagories.

---

5. See Tables 7, 8, 9, 10 and 11 on pages 49, 51, 52, 53 and 55 respectively in the National Agricultural Credit Study for further information on the distribution of FmHA borrowers over the loan catagories and economic characteristics discussed.

The type of farmer receiving Economic Emergency (EE) loans in 1979 was rather different. For this loan category there was much less lending activity concentration, in terms of the percent of money loaned and, to a lesser extent, the percent of borrowers in the group of young, limited resource farmers. For example, fully one-third of the funds lent under the EE loan program went to farms with gross farm sales of over $100,000 and total property holdings worth more than $500,000. In the early 1980s, the scope of this program was severely reduced, though the administrative mechanisms remain in place and a relatively small amount of money was disbursed under this category in 1984. Data were not presented in the National Agricultural Credit Study on the distribution of emergency disaster loans over the economic characteristics of borrowers. However, because this loan category includes provisions for granting loans without a credit elsewhere test, it is probable that the pattern of lending in the ED program is more similar to the EE program than the FO or OL programs.

Projected Economic Conditions in Agriculture

Consideration of the role of FmHA during periods of economic distress is particularly important when we consider the projections of the agricultural economy over the next fifteen years. Projections made by the CARD model indicate that agricultural producers are expected to become less solvent over this period (Penson). CARD projections imply continued debt servicing difficulties and declines in real net farm income. In short, indications are that the next fifteen years may be ones of serious financial difficulties in agriculture.

It is instructive to examine FmHA lending activity over the period 1971 to 1984, because these years contain a boom period (1973-

1976) as well as a period during which the agricultural sector was relatively depressed (1980–1984). Tables 3 and 4 track the percentage of the outstanding real estate and nonreal estate farm debt owed to various lending institutions.

The data in Table 3 indicate that the Farm Credit system (FCS), represented by the Federal Land Banks, has steadily increased its share of the farm real estate market. Insurance companies, private banks, and individuals lost market share over the period. FmHA held a relatively constant share of the farm real estate market from 1971–1973. In 1973, and continuing until 1979, FmHA's share declined. FmHA's market share returned to the pre–1973 level in 1980 and it has shown modest growth since that time. The pattern indicates that during and immediately after the financial boom experienced by agriculture in the early to mid 1970s, the importance of FmHA as a real estate lender declined. This implies other lenders, especially FLB, were willing to increase their lending activities during this period. The increased market share held by FmHA in the 1980s indicates both farmers' increased reliance upon and the government's willingness to fund FmHA during periods of economic stress.

Table 4 shows rapid growth in FmHA's role in the nonreal estate lending market since 1977. The major causes of this growth were the implementation of the Economic Emergency loan program and expansion of the Emergency Disaster program. FCS (PCAs and FICBs), private banks and individuals all lost market share over the period. Private banks remain the dominant player in this market.

The conclusion drawn from Tables 3 and 4 is that FmHA is a more important participant in both the real estate and nonreal estate loan

Table 3: Percentage of Farm Real Estate Debt Outstanding 1971-1984 Held by Various Lenders.(a)

Year	Institution				
	FmHA	Federal Credit System(b)	Private Banks	Insurance Companies	Individuals and Others
1971	8.0	23.5	12.4	18.5	37.5
1972	8.1	24.5	13.1	17.3	37.0
1973	8.1	25.8	13.7	16.1	36.4
1974	7.6	27.6	13.8	15.1	35.9
1975	7.2	30.0	13.4	14.1	35.3
1976	6.8	32.2	12.7	13.6	34.8
1977	6.6	33.5	12.3	13.4	34.2
1978	6.3	33.8	12.3	13.9	33.7
1979	5.8	34.5	12.0	14.7	33.1
1980	8.3	34.7	10.1	14.3	32.6
1981	8.1	37.6	9.2	13.5	31.6
1982	8.3	41.3	7.9	12.4	30.1
1983	8.3	43.1	7.7	11.7	29.2
1984	8.5	43.0	8.3	11.4	29.0

a. Data from U.S.D.A., AFO-25, 12/84, Pg. 23.
b. Federal Land Bank

Table 4: Percentage of Farm Nonreal Estate Debt Outstanding 1971-1984 Held by Various Lenders.(a)

Year	Institution			
	FmHA	Federal Credit System(b)	Private Banks	Individuals and Others
1971	3.3	22.8	46.0	20.1
1972	2.8	23.1	45.7	20.2
1973	2.6	23.0	48.1	20.2
1974	2.6	24.1	50.8	20.3
1975	2.8	26.6	49.3	20.4
1976	4.2	26.4	48.1	20.4
1977	3.9	25.8	47.8	20.5
1978	5.3	23.2	43.3	20.6
1979	8.3	22.1	40.7	20.6
1980	11.2	23.2	38.6	20.7
1981	13.6	23.6	36.5	20.5
1982	15.6	22.8	34.3	19.5
1983	13.8	19.6	33.8	18.3
1984	14.2	19.0	37.9	18.4

a. Data from U.S.D.A., AFO-25, 12/84, pg. 24.
b. Production Credit Associations and Federal Intermediate Credit Banks.

markets during periods of economic stress. Given the projected performance of the agricultural economy over the coming decade, demand for FmHA services is expected to be strong.

Implications of the Foregoing Analysis for FmHA

This paper has presented the case that the supply of new agricultural technologies is increasingly dominated by private research organizations. The imperatives of the marketplace imply that the research and marketing efforts of these private institutions will be directed toward the needs of larger commercial farms. This conclusion is supported by the pattern of adoption rates predicted by OTA scientists. The profile of the typical innovator drawn by economists and sociologists also indicates, in general, a farmer with above average capacities (in terms of access to human and financial capital, ability and willingness to bear risk, and ability to produce efficiently).

Agricultural markets are expected to be weak over the next decade. It might be assumed that when the farm economy is depressed, the process of adopting new technologies stops because of lack of funds and pessimism about future returns. However, hybrid corn swept across Iowa during the most severe portion of the Great Depression. The point is that investments in new technologies which significantly improve the absolute and/or relative profitability of a farm or group of farms are likely to take place regardless of market conditions. A caveat must be added to this very strong statement. Innovation during a period of economic stress is much more likely if the new technology has good congruence and low capital costs. In terms of the four-quadrant diagram in Figure 2, hard times in agriculture are likely to

limit adoption activity to innovations which fall into the lower left-hand quadrant.

Clearly, factors such as low commodity prices, high input prices, and weak foreign demand affect who adopts new technologies and when. What is likely, however, is that the introduction of a new technology at a time of poor sector performance will enhance the economic position of farmers in more favorable financial or environmental positions. Returning to the experience with hybrid corn, the first and most rapid adoption took place in areas such as Iowa where the economic benefits were, according to Griliches' research, most concentrated. Based on this experience, we argue that a low growth period, such as the one predicted for agriculture over the near term, will increase the relative advantage of favored farmers and regions.

The implication of the foregoing discussion is that relatively few of the farmers served by FmHA will adopt and prosper from the new technologies. For cases in which FmHA clients are able to adopt the new technologies, the agency could be an important source of capital. For the bulk of its clients, FmHA, as currently structured, is likely to serve as caretaker for businesses in transition. Many of its clients will be forced to make the transition from primary dependence on farming for a livelihood to dependence upon non-farm activities. The technologies that are emerging will only hasten this transition.

A number of questions arise from this conclusion. First, is this conclusion acceptable from political, economic, and social points of view? Second, if a more active role in the innovation process is sought for FmHA, how are its goals to be defined? Thirdly, what institutional innovations would be necessary to allow FmHA to fulfill this mandate? Finally, what "second generation" effects might arise

from special FmHA programs designed to facilitate innovation?

FmHA and Technological Change: a Role for the Future

FmHA has had, as noted at the beginning of this paper, several mandates over the course of its existence. One of the mandates given FmHA was to facilitate the entry of young farmers into agriculture. The emergence of new technologies and the uncertainties regarding the performance of the agricultural sector over the next fifteen years make this function even more important.

Options for FmHA's Future Role

Central to the debate on FmHA's future role in the process of technological change, is the question of adoption constraints. Several barriers have been identified which would have to be removed or diminished if the farmers served by FmHA are to be a major beneficiaries of the emerging technologies.

Many of the technologies that will influence agriculture in the coming period will not require major capital investments in order to be adopted by the majority of farmers. However, even today many of FmHA's clients control too few resources to compete effectively. Some of the technologies that will be developed between now and the year 2000 will only exascerbate this situation. One option for FmHA would be to change the type of clients it serves. It makes little political or economic sense to change the focus of FmHA to the larger, more economically viable farms.

A second option would be for FmHA to help their clients attain a more economically viable size. If FmHA increases its lending activities so a specific subsection of the farm population can acquire a new technology and the resources that go with it, serious equity

considerations are raised. Even in the best of times, the special benefits given FmHA farmers pose equity questions. When times in farming are difficult, the rumblings of farmers who can't or haven't taken advantage of FmHA loans grow louder. Selectively providing the means to acquire and utilize new technologies, particularly when this is accompanied by significant increases in the assets controlled by FmHA farmers, would be expected to increase the controversy surrounding the agency. In addition, providing FmHA's clients with more resources does not ensure success unless the the management skills necessary to fully utilize them are also available.

A third option for FmHA is to alter its operations in an attempt to fill an empty market niche. FmHA and other lenders are presently operated to facilitate the acquisition of physical assets. Because payoffs are typically long term in nature, repayment risks are substantial, and little collateral is available, most lenders are very reluctant to provide credit for the acquisition of human capital. The preference for financing physical capital acquisition is understandable from the individual bank's point of view but may result in sub-optimal outcomes for society. For example, society might prefer that a farmer use a loan to buy training in integrated pest management techniques rather than more lethal pesticides.

FmHA could play a particularly important role in the acquisition of human capital, given the nature of most of its clients. FmHA farmers are relatively richly endowed with one resource--labor. Since it is impractical to expand its clients' base of physical capital, a fruitful role for FmHA could be in facilitating the acquisition of human capital. One means of implementing this would be to expand the

training component that is attached to existing FmHA loan activities. One of the hallmarks of early FmHA operations was a substantial farm management/advisory role for loan officers. An increased emphasis on this type of operation would require a significant expansion of the number of personnel in FmHA, greater coordination with public advisory services such as the extension service or increased use of private farm management firms. A second option would be to develop a loan program to finance human capital acquisition. Such loans could be used by the farmer to acquire training directly or to purchase the services of farm financial managers.

Technologies that might be especially appropriate for this loan category are those which lack congruence. Investments in human capital to learn how to use these technologies could be used by FmHA farmers to improve the management of their farms. In addition, they might be capitalized by selling their expertise to other farms. Finally, these training investments would facilitate the transition out of agriculture for those who decide to leave the sector.

Summary and Conclusions

It has been argued that to understand the role federal credit programs may play in facilitating the adoption of new technologies, it is necessary to understand the system producing these innovations. Most of the emerging technologies identified by the OTA study are based on biological or information sciences and most will be developed by private companies. Until comparatively recently, a major portion of the biological innovations came from the public sector. Greater private sector involvement in these types of innovations is likely to alter the type of technology that emerges. Biological innovations

will tend to favor larger farms and hence contribute to the trend toward fewer and larger farms in the U.S. Larger farms will be the principal beneficiaries because marketing efforts will be directed at them and because they have greater access to sources of debt capital.

The impact of the information technologies is less certain, in large measure because the major investment required to take advantage of these innovations will involve human capital rather than physical capital. Historically, capital markets have not been actively involved in financing human capital formation. Because of the importance of the human capital investments and because the cost of purchasing the hardware and software necessary to utilize the information technologies is relatively low and will continue to fall, the ultimate impact of this set of innovations on the structure of American agriculture is difficult to predict. It is likely, however, that the marketing and financing factors which favor large farms in the biological innovations will also work to the advantage of larger farms in the information-based technologies. Even if larger farms choose not to make the human capital investments necessary to utilize the information technologies, it is probable that they will purchase these services from others.

The emerging technologies were arrayed on a four quadrant graph with physical capital requirements on the horizontal axis and human capital requirements on the vertical axis. Many of the emerging technologies will have relatively low capital requirements. Operating capital will be used to finance the adoption of most of them, particularly the technologies based on biological sciences.

The purpose and clientele for public credit programs were examined. Federal credit policies have, in the past, been directed at

eliminating real or perceived credit gaps, reducing entry barriers and facilitating adjustments to emergency situations of various sorts. Many feel that the credit gaps that were evident in the pre-World War Two period have, by and large, been eliminated. On the other hand, the barriers to entry into farming remain formidable and FmHA's "safety net" role has become extremely important, for both political and economic reasons. The farmers served by FmHA have, with some notable exceptions, been drawn from the lower end of the economic spectrum. Given their resource endowments and the nature of many of the technologies that are emerging, the conclusion is reached that clients served by public lenders are not the most likely adopters of new technologies given the current institutional setting.

Finally, it is argued that if the foregoing analysis is correct, FmHA should consider a significant shift in operations. Historically, FmHA played an important role in human capital formation in agriculture. FmHA loan officers were actively involved in the management of their clients' farms, particularly the management of farm finances. Given the increasingly important role played by debt capital in agricultural finance and the volatility of agricultural markets, sound financial management of the farm business was never more important than it is today. FmHA might provide more farm financial management services.

At a more ambitious level, FmHA might consider the development of a special class of loans devoted to human capital formation. Loans used by farmers to acquire the skills necessary to take advantage of the emerging technologies which require major human capital development could have two beneficial effects. First, skills would be

learned which would improve the management of these smaller farms. Given that many of these farms are at a competitive disadvantage in terms of the amount of resources they control, the management of their resources becomes of paramount importance. Second, the skills acquired by these farmers would have wide applicability in the farm and non-farm sectors. It is possible that these skills could be sold to other farmers as a source of off-farm employment or could be used in the broader economy if the individual decided to leave the farm or seek off-farm employment. In short, human capital investments would be expected to increase the long term economic viability of loan recipients whether they remain in farming or make the transition to the non-farm economy. Improving their clients' economic viability has, from the beginning, been the ultimate reason for FmHA's existence. The suggestions contained in this paper conform to this goal.

References

Barry, Peter J., "Regulatory and Performance Issues for Financial Institutions: Their Effects on Technology Adoption and Structural Change in Agriculture," paper prepared for the Office of Technology Assessment, October, 1984.

Bogue, Allan G., Money at Interest: The Farm Mortgage on the Middle Border, U. of Nebraska Press, 1969.

Bonnen, James, "Historical Sources of U.S. Agricultural Productivity: Implications for Research and Development Policy and Social Science Research," Am. J. Agric. Econ., 65, 5, 1983.

Brake, John R., "Short Term Credit Policies for Dealing with Farm Financial Stress and Their Impacts on Structure and Adoption of New Technologies," paper prepared for the Office of Technology Assessment, October, 1984.

Cochrane, Willard W., The Development of American Agriculture, A Historical Analysis, University of Minnesota Press, 1979.

Evenson, Robert E., "Intellectual Property Rights and Agribusiness Research and Development: Implications for Public Agricultural Research Systems," Am. J. Agric. Econ., 65, 5, 1983.

Griliches, Zvi, "Hybrid Corn: An Exploration in the Economics of Technical Change," Econometrica, 25, 4, 1957.

Hathaway, Dale E., "The Federal Credit Programs for Individual Farm Development," Federal Credit Agencies, Research Study Five, Commission on Money and Credit, Englewood Cliffs, N.J., Prentice Hall, 1963.

Hughes, D., S. Gabriel, R. Meekhof, M. Boehlje, D. Reinders, G. Amols, "Financing the Farm Sector in the 1980s: Aggregate Needs and the Roles of Public and Private Institutions," National Agricultural Credit Study, U.S.D.A., Washington, D.C., April, 1981.

Johnson, D. Gale, "The Crdit Programs Supervised by the Farm Credit Administration," Federal Credit Agencies, Prentice Hall, Englewood Cliffs, N.J., 1963.

Lins, David A., "Overview of Capital and Credit Markets Serving Agriculture," paper prepared for the Office of Technology Assessment, October, 1984.

Penson, John B. Jr., "Adoption of Emerging Technologies in Agriculture: Implications for Future Financing Needs," paper prepared for the Office of Technology Assessment, January 1985.

"Project 1995", Farm Bank Services, Denver, CO., June 1984.

Rogers, Evert, Diffusion of Innovation, The Free Press, N.Y.

U.S.D.A., "Agricultural Finance: Situation and Outlook," ERS, Washington, D.C., 1984.

U.S.D.A., "Federal Credit Programs for Agriculture: Background to Farm Legislation," AIB 483, Washington, D.C., November, 1984.

Background Paper No. 6

Short Term Credit Policies for Dealing with Farm Financial Stress and Their Impacts on Farm Structure and Adoption of New Technology

John R. Brake
Cornell University

March 1985

Office of Technology Assessment
U.S. Congress

This background paper was prepared for the assessment "Technology, Public Policy, and the Changing Structure of American Agriculture." The views expressed are those of the author(s) and not necessarily those of OTA.

Short Term Credit Policies for Dealing with Farm Financial Stress
and Their Impacts on Farm Structure and Adoption of New Technology

by
John R. Brake
Cornell University

Summary

The purpose of this paper was to assess short-term credit policies that may be considered as treatments for the current financial stress of farmers. The analysis did not speak to specific bills or programs which typically contain several different credit approaches. Instead, the emphasis is on specific approaches--a generic treatment, in effect.

Current financial stress (or distress) of farmers is believed to be the most serious since the 1930s though, as yet, the present problems are not as widespread among all farmers as in the 1930s. Rather, present problems seem to be directly related to the unserviceable debt loads of many farmers. Hence, low debt-to-asset ratio farmers, in general, are not as financially stressed as are high debt-to-asset ratio farmers. Current problems stem from lower farm incomes and high interest rate levels which have caused farm fixed and durable asset values to fall. For some highly leveraged farmers, debt has become unserviceable from their income. Cash flow shortfalls can no longer be financed from asset capital gains, and in fact, lowered values of land and durables caused deterioration of individual balance sheets which in turn tended to dry up credit even more.

Without improvement in the income level of farmers or the interest rates paid on farm debt, farm asset values may fall even further. Additional farms will fail. Additional financial institutions providing credit to farmers will fail, and the financial condition of large numbers of farmers and of farm lending institutions would weaken. Raising income levels through farm commodity price programs to meet the financial stress would cause further loss of share in international markets and would maintain artificially high farm asset values compared to free market levels.

In all likelihood, short-term farm credit policies will receive consideration as one means of dealing with the current financial stress of the nation's farmers. A number of such policy approaches was discussed and evaluated in terms of effectiveness in the short and long run, government involvement required, public versus private lender costs, and possible structural effects.

In general, and as might be expected, the more effective short-term credit policies are likely to be the most expensive. This is because the problem is generally directly related to debt service costs. Those policies judged to be more effective include a short-term waiver of interest, write-down of loans, interest subsidies, and interest rate buy-downs. These policies involve direct reduction in debt service costs. Debt restructuring also has considerable potential and is a less costly policy except that government guarantees may be required to encourage lenders to restructure borrower's debts. (Deferral of interest and/or principal payments could be effective if the problem turns out to be short term in nature.)

Since one of the factors affecting stress is decreased values of farm land, policies which ease that downward pressure could be helpful. Having public or private lending institutions hold land off the land market to stabilize prices could help; but in the case of private lenders, the Federal Reserve may need to provide longer term discount window credit to provide bank liquidity. Also, changes may be required in policies and procedures of state regulators to permit such holdings without forced and inappropriate write-downs of bank collateral values.

Probably short-term credit policies should have the goal of facilitating adjustments and reducing severe downward volatility of farm asset markets. Those goals may well be achievable by such policies. Undoubtedly, some advocates will want policies, instead, to keep financially distressed farmers in agriculture until times improve; and that may not be a realistic objective.

Without substantial improvement in the incomes and/or interest rate situation facing farmers, none of the short-term credit policy options appears to have great promise over a five to ten year period. Fundamental help for the longer term is more likely to be a function of monetary and fiscal policy, i.e. general economic policy, and perhaps even farm price and income policy, than of short-term credit policies.

The financial stress of farmers has implications for the size structure of farms and for the adoption of new technology. Without special farm credit programs to alleviate financial stress, a higher proportion of larger farms will likely fail than of small sized units. Also, many large farms are still "family" units. With special programs, structural effects depend on which policies are used and their targeted groups. The adoption of new technology is slowed in periods of financial stress; but the impacts are more severe for capital intensive investments and durables with multiple year lifetimes. Short-term credit policies to reduce financial stress would likely improve the adoption of new technology relative to no special policy for dealing with stress although the profitability or cost reducing nature of the new technology is of key importance to its rate of adoption.

Short Term Credit Policies for Dealing with Farm Financial Stress and Their Impacts on Farm Structure and Adoption of New Technology

by
John R. Brake
Cornell University

Perspective on Current Financial Stresss

Farm financial stress has gained much attention the past year or two. Financial stress arises in several ways. It may be a perceived inability to meet cash flow commitments whether in the form of cash farm expenses, debt service requirements, taxes due, or family living needs. Financial stress can also come from a negative income, or loss of net worth through devaluation of assets, or a substantial discrepancy between financial expectations and actual results.

Policymakers are concerned with this farm financial stress. Numerous options have been, and will be, discussed for alleviating the stress. One type of option which is likely to receive consideration, and in fact already has, is short term credit.

The purpose of this paper is to discuss and analyze various short term credit options which have been, or might be, considered. The discussion attempts to assess each such option in terms of 1) its effectiveness in alleviating financial stress, 2) its effect on the future size structure of farms, and 3) its effect on adoption of future new technology.

In meeting this purpose, the paper first describes the current farm stress and its roots. Next, goals, objectives and criteria for judging public farm policy and farm credit policy are briefly discussed. The paper then focusses on types of short term credit policies. Each policy approach is defined and analyzed. In the final section, short term credit policy impacts are related to specific aspects of structural change and adoption of new technology.

Descriptive Characteristics

Some analysts describe financial stress by use of figures on debt/asset ratios of the farm sector. Such analyses show that the sector average debt/asset ratio increased from

approximately 12% in 1960 to slightly over 20% by 1983. Over that period, credit use by the nation's farmers increased year after year. Hence, the increased debt/asset ratio represented increasing credit use related to increasing asset values. From 1981 to 1983, however, asset values declined as did the rate of increase in credit use.

Of more importance than the average debt/asset ratio of the sector is the distribution of farm operators and debt owed by debt/asset ratios (USDA 1983 Farm Production Expenditure Survey). In January 1984, approximately 6.6% of the nation's farm operators had debt/asset ratios greater than 70%. About 17.7% had debt/asset ratios greater than 40%. Debt use, however, is strongly associated with farm size, and 13.5% of those farms with annual sales greater than $250,000 per year had debt/asset ratios over 70%. And, 32% had debt/asset ratios greater than 40%. By comparison, of farm operators with gross sales of $25,000 to $250,000 per year, less then 9% had debt/asset ratios greater than 70%, and about 23% had debt/asset ratios of 40% or more. For small farms, those grossing under $25,000 of annual sales, only 4.4% had debt/asset ratios greater than 70% and only 8% had debt/asset ratios of more than 40%. Clearly, debt use is closely related to farm size. Unfortunately, there are no data available to illustrate debt use by years in farming. We know, however, that beginning farmers typically use more debt than well established farmers. To the extent that debt/asset ratios show potential financial problems, operators of larger farms and beginning farmers are likely to be in more difficulty than other farmers. (There is some evidence, however, that the very largest farms, having sales over $500,000, have less incidence of stress than those from $250,000 to $500,000.)

Another important aspect of the outstanding debt from the lenders standpoint concerns the risk of default. If those with the highest debt/asset ratios are more likely to suffer losses, then there are important risk elements facing agricultural lenders. On January 1, 1984, 24% of the total agricultural debt was owed by farm operators with over a 70% debt/asset ratio. Another 32% was owed by operators with debt/asset ratios in the

range of 40 to 70%. Hence, 56% of outstanding debt was owed by operators with debts greater than 40% of their assets. This was, and is, a matter of great concern for lenders since decreases in asset values or poor farm incomes will more quickly erode the equity ratios of highly leveraged operators than of high equity operators.

Lenders also have a concern since they are also highly leveraged. Farm lenders typically have equities of 8% to 10%, and in some cases, as little as 5% or 6%. Their assets consist primarily of loans. Hence, an "average" farm lender would find 56% of its farm loans due from operators with a greater than 40% debt/asset ratio. These are the operators in financial distress, and loan losses could quickly erode the 5-10% equity of the typical lender.

While such distributions of debt/asset ratios are useful and informative, they are only proxies of financial stress or distress. More important in showing stress are figures on debt burden, delinquency rates, foreclosure rates and the like. Data are not always available as desired, but existing data indicate that about 1980 or 1981, farmers began to have difficulty meeting cash flow commitments. Delinquency rates, charge-offs, and loans in process of liquidation rose in 1981 and have continued to rise in years since. For example, PCA loan charge-offs were under 0.1% in 1978 and 1979. However, by 1983, these had risen to 1.2% of outstandings. Similarly, loans in process of liquidation were negligible in the late 1970s. Data on those were not even kept in the Farm Credit System. By 1982, loans in process of liquidation approached 1% of outstandings, and as of March 31, 1984, PCA loans in process of liquidation were over 2.5% of outstandings.

One notable characteristic of the present period of financial stress is its close association with debt. In any year, some farmers fail. Typically, "poor management" can be cited for the failure. In the 1980s, however, failure has been more closely correlated with debt use and debt service requirements than with any other single factor. "Good managers" (i.e. good production managers and successful managers in the past) are failing as well as "poor" managers. Two or three points will help to illustrate. For years,

interest expenses amounted to no more than 4% or 5% of total farm cash operating expenses. By 1975, interest was 10% of cash farm expenses. By 1983, interest had risen to 18% of total cash farm expenses. Further, farm income had declined over this period.

Still another useful figure for illustrating debt service requirements is the percentage that interest is of cash receipts after payment of intermediate production expenses, business taxes, wages and rent. Interest as a percentage of this latter figure had risen to 17% in 1975. By 1978, interest had become more than 20% of cash receipts after other expenses. In 1981 it reached 35% and has since remained in the range of 34% to 38%. Considering that cash receipts after payment of intermediate production expenses, business taxes, wages and rent have to pay: 1) for the operator's labor, 2) for use of owners equity in the business, 3) for purchases of new capital durables such as machinery, and 4) for interest and principal, it is clear that the debt service burden has become much greater in the last several years.

Farm financial stress is affecting rural communities. There are few studies available to show the effects of severe farm financial stress on rural communities. Clearly some businesses providing inputs to agriculture have been severely hurt in the last several years. Farm machinery dealerships are prime examples. Many dealerships have failed. Other farm supply firms and many country elevators have failed as well. Also, increasing numbers of rural banks have failed or are experiencing severe financial problems. Rural bank failures likely impact rural communities even though FDIC insures losses of most depositors. Banking services may have to be obtained in another community and/or financial services competition will diminish. Perhaps one of the most serious consequences of rural bank failures is that some farmer borrowers may not be able to find a replacement lender.

Reasons for Current Financial Stress

What led to the severe financial stress of farmers in the early 1980s? The basic causes could be listed as follows (Brake, 1984):

1) A changing mix of macroeconomic policy beginning in 1979 had investment implications for farmers. A restrictive monetary policy and expansive fiscal policy produced unusually high real interest rates resulting in high debt service costs and a strong dollar. Hence, the high inflation, low real interest rates, growing export market expectations, of the 1970s were quickly invalidated as we entered a new era in the 1980s.

Other economic policy changes as well affected the financial environment of farmers. Deregulation of financial institutions and markets transmitted interest rate risk into the agricultural sector with a new intensity. A worldwide recession exacerbated the slowing of exports from the strong dollar. And, with the deterioration in exchange rates, other suppliers jumped into world food markets.

2) Numerous farmers used too much debt in relation to their debt repayment ability as they followed a strategy that was successful for most of the 1970s. The rapid inflation and high returns to assets over the 1970s made a high-leverage strategy profitable. That strategy became unprofitable and inappropriate in the 1980s.

3) High interest rates as stated substantially increased the debt service burden. These high interest rates were made even worse for the farm sector because of the relatively large proportion of total farm debt that is on a floating rate basis. That is, higher interest rates were quickly assessed on a major part of farm debt.

4) Natural disasters were a contributing factor as several sections of the country experienced drought or floods. High costs of debt in a year of lost income rapidly eroded equity.

5) Government credit to agriculture ceased to carry a substantial interest rate subsidy. This credit now carries high interest rates making debt very expensive to service from present levels of commodity prices.

6) "Generous" farm price supports encouraged overproduction. Milk surpluses, for example, created a need to reduce production. That adjustment is being forced through lowered profitability.

In summary, a number of factors contributed to the farm distress of 1983-84. The basic factors, however, were the abrupt changes in policies, expectations, and previous relationships. These brought farmers into a new and unexpected environment. The capital gains associated with the farm land price spiral of the 1970s have already partially disappeared in the 1980s. Whether the remaining gains will continue to erode away or be salvaged by government policies is a major question before policymakers (Melichar, 1984). Interest rate risk has been shifted to farmers and away from lenders. But, with that shift came a substantial increase in risk of loan defaults. Farmers were unprepared to deal with the substantial interest rate risk; and as a result, loan defaults, delinquencies, and farm failures have risen above any other experience of the past 40 years.

To deal with this financial stress of U.S. farmers, short term credit policies are receiving attention. A fundamental issue must be considered, however. That is whether the current financial stress is a short term phenomenon or whether it is, instead, the first phase of a new era with basic changes in fundamental relationships. If, for example, farm incomes remain in the $20-$30 billion range due to relatively low farm commodity prices and continued foreign currency exchange disadvantages, and if interest rates remain high, then a significant part of U.S. agriculture will have trouble servicing its debt. Perhaps still further decreases in farm land values, used machinery values, and other durable values can be expected.

Many of the proposals--particularly the short term credit proposals--to deal with the 1983-84 financial stress are based on the assumption that the problem is a short term phenomenon and will shortly disappear. If the current problem is simply a cyclical downturn, then the phenomenon may be short term. But if, instead, it is a structural trend adjustment to a new plateau of interest rates and a much more expensive dollar in international trade, then short term proposals will be ineffective in treating the basic, new relationships. There is substantial evidence that the situation is structural. If so, national and international policies affecting U.S. interest rates and dollar exchange values

will be more important to the solution of agriculture's present financial problems than will short term credit policies.

Relationships of Credit Policies to Technological Change

While it is difficult to point to specific research showing direct linkage between credit and technological change, the issue has received considerable attention from economists. Development finance economists have concluded that credit is an important determinant of technological change in developing countries if new technology is available and profitable. There is also general agreement among agricultural finance economists in the U.S. that the history of availability of credit to the sector and its cost reducing nature has had a strong influence on rapid technological change.

In the current situation, two aspects are important. First, the existence of financial stress in a number of farm operations can be expected to limit the adoption of new technology on those farms. Low income potential, cash flow pressures and lender-imposed limits on borrowing are not conducive to adoption of new technology. However, a cost-saving new technology might still find a rapid rate of of adoption.

The second point concerns capital requirements for adopting new technology. Of significance is whether the new technology can be acquired in an operating expense mode or whether it involves a major investment in durable capital goods. Presumably, the development of most new technology requires an infusion of capital. However, the development costs may be borne by a public institution, a research firm, or an agricultural input supplier. The result of that product development, (i.e. the adoption) might be available for purchase as an operating expense. New technology of this sort, such as hormones, plant nutrients, new seeds and the like, would be less limited by the availability of credit. But, new technology that requires a major capital investment by farmers with benefits spread over many future production periods would be much more heavily dependent upon credit availability. Also, the cost of credit is very important with such

major investments because the rate of return has to be in excess of market interest rates to encourage rapid adoption.

Short Term Credit Policy Objectives and Criteria

Before discussing alternative proposals for dealing with financial stress, it may be useful to obtain perspective on policy rationale and objectives with respect to agriculture, and more specifically, with respect to agricultural credit. Knutson (1983) indicates three basic reasons for government policy concerns in the farm sector: 1) The importance of food to life and the importance of the agricultural sector. 2) The inherent instability of agriculture due to the inelastic nature of supply and demand and the resultant large fluctuations in prices. (These fluctuations, he argues, are exacerbated by the continuous adoption of new technology which tends to increase supplies of food and aggravates the problem of surpluses.) 3) The disadvantaged market position of farmers who must purchase inputs from firms possessing considerable market power and who sell on markets with unstable prices with little ability to affect their output prices.

Breimyer (1983) lists the overall goal of the food system "to utilize our resources for producing and distributing food in a manner that balances the twin goals of meeting at least the minimum needs of human beings and of rewarding participants proportionately to their contribution." Dorow (1983) describes the goals of the agricultural sector as efficiency, increasing productivity, and a desirable structure. He says credit policy is important because an abundance of low cost capital helps induce adoption of new technology. Further, credit policies, he says, influence farm structure and help beginning and/or low resource farmers compete with larger, established firms.

Lee, Gabriel, and Boehlje (1980) list four goals of agricultural credit policy: 1) to provide money to farmers for producing food and fibre needed by the country, 2) to assure an economically healthy and viable farm sector, 3) to promote efficient use of

resources, and 4) to enhance the equitable distribution of economic rewards and opportunities.

Several other reasons for government policies or intervention should be listed. First, one could argue that the public bears some responsibility because it contributed to bringing too many resources into production. Second, government has often intervened in times of market failure or imperfection. It has responded to gaps in private credit markets, and it has responded to emergency situations in which private credit markets were strapped.

While such general goals are useful in understanding government objectives in agricultural and agricultural credit policy, there are other issues and criteria to be considered in deriving short term policies to solve specific problems. For example, one might ask: 1) Why are objectives not being met through the market mechanism? 2) To what extent will the specified federal program alleviate the problem? 3) Are undesirable consequences of federal programs too costly? 4) In examining alternatives, it would be useful if one could estimate the degree to which the desired outcome might best be achieved per federal dollar of cost. As a practical matter, of course, this latter is near impossible; but it does help us focus on an important criterion.

In a discussion of the federal government role in credit, Slater (1982) raises similar questions which also imply criteria for government credit programs: 1) Do government credit programs have a lasting impact on the allocation of real resources? 2) Do such programs inhibit the kinds of changes that would entice other lenders to lend? 3) Is government credit serving, instead, as an instrument of political favoritism hidden from public view?

To summarize briefly, specific farm credit policy goals include adequate food supply, efficient use of resources, healthy farm sector, equitable economic rewards, and functional financial markets. Previously presented data on the economic problems

suggest several of these goals are not currently being met. The justification for special government programs comes from the need to better accomplish these goals.

Of importance, too, is the issue of how serious the current financial stress is. Is there a greater need for attention of policymakers now than "normally"? To say it differently, every year some farmers go out of business for one reason or another. When do we agree that conditions are unusual and that, therefore, unusual policies become necessary? There is probably no precise answer, but some perspective may be useful.

The 1930s depression is one base point that can be used for comparison. Munger and Feder (1957), in describing the 1930s, indicate that land values nationwide dropped more than 50% from 1920 to 1933. For many farmers, the value of their land dropped below their real estate debt. Farm foreclosures nationwide reached 39 per thousand farms in 1933 alone. Forced sales affected 29% of U.S. farms from 1930-39, and the figure exceeded 40% of farms for North Dakota, South Dakota, and Nebraska.

Certainly 1984 was not in the same category of stress as the 1930s. "Only" 17.7% of farmers had debt/asset ratios greater than 40% in 1984. Yet, the situation is serious, and especially serious, in some parts of the country; and, it is more serious than at any time since 1940, at least. Two important data underlie this observation. First, there has been no other period of land value decrease nationwide or by region that compares with the decrease in land values (and other durables) that occurred from 1981-84. Second, the debt service burden of farmers (interest payments as a proportion of net cash income after paying other farm operating expenses) has at no time since 1950, at least, been as high as from 1981 to the present. Debt service currently takes twice as much, or more, of net cash income after other operating expenses than in the 50s, 60s, and 70s. And, many farmers are giving up.

Experience of lenders also exceeds "normal" bounds. An unusually large number of agricultural banks has failed. At least a half dozen PCAs have lost all their capital. The FICB-PCA system wrote off almost as much "bad loan" volume in 1983-84 as in all the

rest of its 50 year history combined. Loan losses and delinquencies continue to run at many times their 1970s rates at agricultural lending institutions.

The above data suggest to this anaiyst that we are, indeed, beyond "normal" experience and that special programs are called for, especially to facilitate adjustment and to ease the transition for impacted farmers and lenders.

Issues in Judging Policy Proposals

A number of issues need to be faced when judging or deciding upon policy proposals.

What is the Purpose of Special Programs? This is a basic issue. Should special programs be designed with the intent of keeping present farmers in farming? Even if this were the purpose, and such purpose is very questionable, the costs would likely be prohibitive. In fact, probably a part of the present problem is that previous government programs and ill-founded expectations reduced the normal number of exits from farming in the 1970s.

Instead, special programs will likely build on one of two assumptions. Some analysts see the present financial stress as a short-term cyclical downturn which will recycle to better times within a few years. Based on this view, special programs will be designed to help those financially stressed operators who appear to have promise to bridge the gap to better times. This purpose might fit, for example, those operators whose situations were exacerbated by drought, flood, etc. It would even help those with overleveraged positions and low incomes if a major world weather problem were to substantially improve prices within a couple of years.

The second purpose builds on the assumption that fundamental relationships have changed causing farm capital investments to be revalued downward and pushing many farm operators to exit from the sector. Special credit programs building on this assumption will be designed to provide a temporary bridge to cushion the impacts and the

rate of change. Such programs would aim toward providing liquidity to the sector, keeping land, durables and financial markets from overreacting, and otherwise helping to bring about an orderly transition while large numbers of farmers exit from the sector.

Who Qualifies for and Who Implements Special Programs? Any time there is a public benefit to be obtained, criteria have to be set up so that the program is available and limited to the target group. Also, of course, there are limits on public expenditure; hence, we want the largest benefit per dollar of public expenditure. Past public farm credit programs, and particularly FmHA programs, would suggest that emphasis be given to low resource or family units. Further, one expects that additional criteria would apply so that only those operations which could not survive without FmHA help would, in fact, get the help.

There are difficulties in application, however. One involves the specific lending criteria to be applied. Criteria will have to be stated publicly, and once those criteria are known, borrowers and private lenders will attempt to use the program to transfer their losses into the public program. A second difficulty in targeting family units and low resource units is that definitions can cause inflexibility in accomplishing objectives. For example, two and three family-member partnerships are very viable forms of organization. They are, in every sense of the word, family units. Yet, they often involve $500,000 to $1,000,000 operations. Typical FmHA lending rules would preclude that agency from helping out an operation with so much capital invested.

A third difficulty with the typical FmHA approach for helping financially stressed farmers is that it may not fit these times. It is entirely possible that units with debt/asset ratios of, say, 80% or more are simply not salvageable in this period of financial stress--short of a massive government involvement to scale interest rates down to half or two-thirds of present levels. Some agricultural finance analysts feel that, instead, emphasis should be put on those farm operations with 40-70% debt/asset ratios since they are the likely ones that can be helped with modest government proposals or

slight improvement in farm output market situations. Following this line of thought, any farm situations with higher than a 70-80% debt/asset ratio would be advised to exit farming. Those with a 40-70% debt/asset ratio would receive counseling and whatever government help is available, and those with under 40% debt/asset ratios would be left to work out of the situation themselves.

A fourth problem with the typical FmHA orientation to qualifications for special programs is that help would be targeted away from larger farm operations. Yet, the statistics on debt distribution suggest that a larger proportion of operators of large farms have high debt/asset ratios. One should note that many of these are, in fact, family operations, though they do not fall within the usual FmHA definition of small family farms. Should substantial numbers of these large, highly indebted operations fail, it would have severe consequences for institutions financing the agricultural sector.

Finally, there is the double-edged issue of equity and expectations. In the minds of those farm operators who exercised restraint and followed a conservative approach to farm land purchases and farm expansion, it is inappropriate for the government to bail out a neighbor who aggressively purchased land and expanded imprudently. Yet, that neighbor, now in financial difficulty, will benefit from a government program to ease financial stress while those who took a more conservative approach, expanded more slowly, and accepted a lower return while they paid back their debt, will receive no government help. Moreover, will further major government involvement to bail out those who are experiencing financial stress reinforce the perception that farmers should undertake risks of high leverage, specialization, or production of price-volatile crops because the government as the insurer of last resort can be depended upon to save them from failure when problems occur?

These are a few of the issues that need attention when designing programs and deciding who will qualify for program benefits. The programs must specify target groups.

That is, someone must decide conceptually, and others directly, who gets the special benefits and who doesn't.

Who Pays for Programs? Any program has costs including a program with no special help to financially stressed farmers. The question is, what costs are we willing to bear and how are those costs to be shared? Doing nothing will have social costs of farmer displacement, financially weakened rural communities, and in some instances, loss of parts of the financial system. These costs are difficult or impossible to measure, but they should be recognized.

Direct program costs can be split several ways. Private sector costs are shared by borrower and lender. Typically the borrower stands all costs up to the limit of his equity. Costs or losses beyond that are shared by lenders. However, if the borrower who sees losses wiping out his equity declares bankruptcy, then additional costs are shifted to lenders. However, in this instance the unsecured lender bears a disproportionate share of losses, often recovering only pennies on the dollar.

Losses by lenders are borne either by stockholders (or owners) of the institution or by other "healthy" borrowers. The latter is the situation in the Farm Credit System where higher interest rates are charged to remaining borrowers to make up the losses incurred.

Finally, the general public can bear some of the direct costs of programs. The decision to be made is how much cost the public should bear, i.e., what is a fair share?

Is Additional Public Investment in Agriculture Inconsistent? The current overall situation in agriculture is that low levels of returns and high interest rates have forced, and are forcing, values of land and other capital durables downward. In an overall sense, this situation calls for capital to move out of the sector in order to raise its level of return. Typically, this occurs in two ways. First, some marginal land goes out of production. Second, the capital remaining in agriculture is devalued. This is occurring, and it negatively impacts individual balance sheets of the nation's farmers. The point is, however, that the return to remaining capital is thereby raised.

There is evidence that land values in some areas, Iowa for example, now about 60 percent of 1981 highs, are at or close to supportable levels. Budgets indicate that Iowa land will generate an 8 to 10 percent cash return, and it will cash flow at current interest rates with 25 percent down payment. In fact, it is now (early 1985) approximately on the long term trend line of 1 percent per year real growth. Hence, unless incomes fall further or interest rates increase again, there may be no economic reason for land values to fall further. However, if large numbers of operators give up or are forced out, the "dumping" of land and other durables onto the market could force values to fall further, and this possibility is a major concern.

Within this context, then, we are considering policies that would require additional government investment in the agricultural sector while the overall economic situation calls for less capital. The two situations are inconsistent in an economic sense. The additional investment from short term credit programs, etc., is being justified, instead, in a social context as a means of reducing personal traumas and tragedies of people who may be facing financial ruin otherwise. It is further justified to ease the transition and keep markets from overreacting downward as just mentioned. Still, as policies are considered, we should recognize the basic economic fundamentals at work. Poorly designed policies to alleviate the undesirable consequences of the current economic situation could well prolong the adjustment period. Probably any intervention should be administered such that funds cannot be used for new capital expenditures and any extra cash flow that results from intervention should be used for reduction in debt obligations rather than capital investments.

Alternative Short Term Credit Policy Approaches

In reaction to the financial stress and distress of farmers, numerous short term credit policy proposals have been suggested. These have come from many sources.

Different approaches were incorporated into dozens of bills introduced in the 98th Congress.

In this section, we discuss some of the different specific approaches. We do not discuss specific proposed legislation because, typically, each bill tends to incorporate several different specific approaches in a (sometimes very slightly) different manner. Instead, it seemed desirable to discuss the different policy approaches. For most approaches there is little research available to draw upon in discussing implications.

For each policy approach, we define and describe the approach, suggest a rationale for it, and assess the effectiveness and results that that approach would likely have toward alleviating financial stress of farmers. Costs, effects on lenders, ease of implementing, and structural implications are discussed whenever possible.

1) Forbearance

Several sense-of-the-Senate and sense-of-the-House resolutions have urged that lenders exercise forbearance in this period of farm financial stress. Forbearance is a conciliatory or compromising approach rather than a hard-nosed approach taken by the lender with those borrowers who are having financial difficulties. Forbearance is difficult to legislate. It has to be accepted voluntarily by lenders. A lender using forbearance would be expected to exhaust various alternatives for improving the quality of the loan such as restructuring the debt, scaling down payments, and working more closely with the borrower to improve serviceability of the loan. The rationale behind the forbearance approach is recognition that these are difficult times for farmers and that many situations can be improved if the lender and the farmer will only cooperate toward that end.

How effective a forbearance approach will be depends entirely upon how severely stressed the farmer/borrower is. For some number of farmers experiencing stress, a forbearance approach improves the situation and may be all that is necessary. These are likely to be farmers with relatively low debt/asset ratios. However, those farmers who

have high debt/asset ratios and, therefore, very high debt service costs in relation to their total cash flow will not be helped very much by forbearance.

Forbearance is not likely to be a very successful policy for dealing with extreme financial stress. It works best where problem cases are few and widely dispersed. It works less well when the problem is widespread and severe because of the thin capitalization (high leverage) of financial institutions. Most lenders are already applying forbearance where appropriate, though there are instances where state or federal regulators who review farm loan portfolios of lenders may have overreacted to the current financial stress situation. That is to say, regulators can overrule a forbearance policy. Forbearance can be implemented by any lender, probably has been implemented by most, and is not costly to implement except to the extent that increased loan losses may eventually result. Implications are that highly leveraged operations remain in business longer before action is taken. Given that a higher proportion of large farms is highly leveraged, structural implications favor larger farms.

2) Moratoria

As the financial problems of farmers have become worse, increased attention and discussion have focussed on debt moratoria as an approach. A moratorium is a stay of proceedings. For example, a moratorium on mortgage foreclosures would stop foreclosure proceedings. Moratoria were used in the 1930s particularly in bankruptcy proceedings. In general, the moratorium was applied to real estate loans only and not to nonreal estate loans. In current times, a moratorium should apply to both real estate and nonreal estate loans to be effective.

Moratoria were applied as follows in the 1930s. In bankruptcy proceedings under the Frazier-Lemke Act, the farm would be appraised and then the court would grant a stay of proceedings (i.e., a moratorium) for three years during which farmers kept the property in their possession, continued to farm, and paid rent for its use. Within three years, the farmer could pay the appraised value and redeem his property. If the property was not

redeemed, it would be sold to satisfy the loans against it. The farmer was not held liable for loan amounts greater than the appraised value of the property or its sales price.

The rationale behind the moratoria approach was to give farmers extra time to salvage their situation. It placed a degree of performance burden on borrowers, but it also limited losses to the property's appraised or sales value.

One of the advantages of general debt moratoria is that the courts in a supervisory position can push the creditors and the borrowers to work out their differences. While the moratorium approach may be beneficial for a few farm situations, it has a number of disadvantages as well. First, in a period of widespread financial distress, relatively few farmers take advantage of the moratorium. Moreover, as Alston (1984) points out, creditors would quickly make adjustments in their lending practices because of the possibility of a moratorium affecting their borrowers. Alston found that creditors did make fewer new loans in states that passed debt foreclosure moratoria than in other states in the 1930s. He also expected to find that creditors raised interest rates to new borrowers, but his statistical results were inconclusive. It is clear in today's framework, however, that Farm Credit System agencies would increase interest rates to remaining borrowers to cover loan losses because that is a requirement of their operating procedures. Other lenders would similarly move to protect their capital and operating margins.

The costs of moratoria proceedings get shifted somewhat to the local level and to public overhead. Certainly court costs throughout the country would increase because of the additional legal proceedings required. Costs to private and public farm lenders would rise from litigation costs and delays from foreclosure on nonperforming loans. Unsecured creditors would bear a disproportionate share of the burden. Moratoria would also tend to keep some of the most financially stressed borrowers in business. To the extent that there are structural implications to debt moratoria proceedings, it seems likely that this approach might slightly favor smaller farms rather than large farms. Both the courts and

lenders would probably be more inclined to favor family or low resource farmers in moratoria proceedings.

A few states still have moratoria laws in effect. However, an up-to-date implementation would require either that states rework present laws or come up with new moratoria legislation, or that federal moratorium legislation be passed by the Congress.

3) Short term waiver of interest

A short term waiver of interest amounts to the lender giving up interest for a stated period. Hence, a waiver or partial waiver of interest would substantially reduce debt service requirements. A partial waiver of interest would be somewhat similar to an interest rate reduction or buy-down discussed later. For purposes here, we differentiate a waiver or forgiveness of interest from a deferral or postponement of interest discussed next.

The rationale behind a waiver of interest is that, during a short period of financial distress, reduced debt service requirements would markedly ease the cash flow problems of the borrower. Once the borrower regains liquidity, interest payments would commence again.

Waiver of interest transfers costs directly to the lender since the lender gives up interest payments for a period. It is a costly approach which the lender could not utilize for a very large volume of loans or for a very long time period. Given its limited applicability, there is little that can be said of structural implications.

4) Deferral of interest and/or principal payments

A short term deferral of interest and/or principal payments reduces debt service requirements. Typically, deferral of interest would reduce debt service proportionately more than deferral of principal payments. In either case, deferred amounts are not forgiven but must be repaid later.

The rationale behind deferral is that the pressure of debt service requirements can be eased temporarily until conditions improve. Then, the interest and/or principal payments could start to be made again.

If the current period of financial stress is short lived, then deferral of interest or principal payments would be a relatively effective means of dealing with the problem. Stress would be reduced as would (obviously) delinquencies and foreclosures. One difficulty with this approach in the current situation is that high interest rates make interest deferrals very expensive. For example, consider a farmer with a $200,000 debt and interest rates of 15%. Deferral of interest payments for two years increases the principal amount to $260,000 ($264,500 if compounded annually). In short, high interest rates make carrying costs prohibitive. If the financial stress is longer term, however, a two or three year deferral of interest payments would only make matters worse.

Costs of deferral of principal payments are minimal, and costs of interest deferral are low, as well, if the economic situation improves soon. If not, costs of this approach tc lenders could be high as borrowers default on the higher amounts of loans outstanding. If a deferral policy were widely applied, it would favor larger farm operations because of the higher proportion of large farms that is highly leveraged.

5) Interest subsidy

An interest subsidy is a loan at below market interest rates. If market rates are 11% and Farmers Home Administration makes loans at 5%, there is a 6% direct interest rate subsidy. Given that overhead costs, in addition, have to be covered, the total direct and indirect interest rate subsidy will be even more than the 6%.

The rationale behind an interest rate subsidy is that some group or some purpose for which such loans are being made deserves special treatment. The interest subsidy is a way of providing this advantage. For many years, the farm ownership and farm operating loans made by Farmers Home Administration were made at subsidized (below market) interest rates. This was done believing that the lender of last resort role of Farmers

Home Administration had certain public benefits for helping young or low resource farmers get started and that these benefits justified the subsidy. Similarly, "disaster" loans in which FmHA lent to farmers that had suffered a natural disaster were at subsidized rates.

More recently, a major part of Farmers Home Administration loans have carried interest rates at the government's cost of money. Hence, these loans involve a much smaller interest rate subsidy.

Given that a major problem contributing to the current financial stress is the high debt service costs being borne by farmers and which costs stem directly from high market rates of interest, then an interest subsidy would be a relatively effective approach for reducing debt service costs to targeted borrowers. Costs of the program would depend directly on the amount of the subsidy and on how many borrowers qualify for the subsidy. If broadly applied so that private lenders could utilize the subsidy as well as public credit agencies, the program could be quite costly. With $200+ billion of debt outstanding in the farm sector, each percentage point of interest subsidy would cost $2 billion if applied to all borrowers. If the subsidy were available only to those borrowers with, say, greater than a 40% debt/asset ratio, then each percentage point of interest subsidy would cost approximately $1.2 billion.

The difficulty of implementing a wide-scale interest subsidy approach to the current farm distress is its high cost which is likely to be unacceptable to the general public. The interest subsidy approach has the undesirable image of being a bail-out for many people who got themselves into trouble from overuse of credit, and of course, the subsidy would help to keep resources in production when excess capacity is a problem. If the interest subsidy were limited only to Farmers Home Administration borrowers or were available only for refinancing through Farmers Home Administration, the program would put a great deal of pressure on staffing resources of that agency, but the cost would be less than if the subsidy were available from all lenders. Recognize, however, that only a part

of distressed farmers is presently in the FmHA portfolio. If an interest rate subsidy program were to be available for all distressed farmers, either it would have to be available through private lenders or there would have to be provision for borrowers from private lenders to have access to the FmHA subsidized rate program.

From a structural standpoint, another consequence of an interest subsidy is that it provides proportionately more dollars to operators of large farms than small. To implement an interest subsidy approach would require an act of Congress if done through FmHA. Such subsidies could also be implemented by states through sale of tax exempt bonds or even with direct state subsidies from state appropriations.

Another form of interest subsidy could be applied through joint lending between a private lender and a public lender such as Farmers Home Administration. In short, the private lender might provide whatever amount of credit its policies would permit, and the Farmers Home Administration would provide the remainder of the credit. For example, if $200,000 of credit were needed and the private lender could provide half, then FmHA would provide the other $100,000 (with an interest subsidy). The interest rate would be a blended rate between the FmHA (subsidized) rate and the private lender's going rate. If Farmers Home loans were 8% and the private lender 14%, the blended rate on the full $200,000 would be 11%. This blended rate proposal is a means for providing some public interest rate subsidy while still utilizing substantial private lender funding of farm debt.

The blended rate approach has several advantages. Benefits could be controlled and aimed at specific targeted groups. Structural implications and program costs could also be controlled to a greater extent. Costs of a subsidized interest rate approach would be borne by the general public. Finally, as interest rates were reduced for borrowers, farm land and durables markets would strengthen (or at least, decline less than with no lowering of interest rates).

6) Public sector credit

Public sector credit would involve new loans by (presumably) Farmers Home Administration as a response to current stress. The rationale for this approach is that farmers are suffering from circumstances beyond their control (i.e. public policy, weather problems or commodity price problems) and that the public sector, therefore, has an obligation to help. FmHA is already recognized as a lender of last resort for natural disasters and economic emergencies. Some policymakers have called for a reimplementation of economic emergency loans to deal with the current financial stress. As judged by past applications, this policy approach would authorize FmHA to lend to farmers hurt by drought, low commodity prices, or similar economic hardships. Given the severe current financial stress in the sector, this approach would lead to a substantial demand for credit from government agencies. Also, private lenders could be expected to attempt to switch their least credit-worthy borrowers to FmHA.

A public sector credit approach such as reimplementation of the economic emergency program of FmHA could impact a large number of farmers. A key factor in its overall effectiveness, however, would be the treatment of interest rates in these economic emergency loans. If the present policy of charging interest rates at government's cost of funds were to continue, then the main outcome of public sector credit programs would be to reduce loan losses of private lenders. Loans at the government's cost would only marginally improve the situation of farmer borrowers. Current interest rate levels are still so high that debt service costs would not be substantially reduced. However, if the public sector credit program were to be linked to an interest subsidy dropping rates to, say, 5% or 6%, then such an approach would reduce debt service costs of many borrowers. It would, also, likely switch lending losses from the private sector to the public sector. Probably loan losses would be reduced substantially, as well, with the lower interest rates. In short, how effective a public sector credit program would be depends importantly on whether an interest subsidy is included in the

program. Without an interest subsidy, public sector credit to relieve the economic emergency would be somewhat less costly (and less effective) than with an interest subsidy.

A public sector credit approach would likely have greater benefits for smaller than for larger farms. It's implementation would probably be aimed at family sized or low resource farms consistent with present FmHA policy. Public sector credit in the amount that would be required to alleviate current financial stress of large numbers of farmers would be viewed negatively by much of the population And, as indicated earlier, major benefits would likely accrue to the private lenders whose loan losses would be reduced by switching their poorer quality loans into the program.

Another form of public sector involvement is a government loan guarantee for qualifying lender loans. The guarantee has been used in instances, for example, to encourage the private sector to make and service certain loans. To provide this encouragement, the public sector guarantees the loans or some proportion of the loans. The guarantee simply means the government would pay that amount or that proportion of the original loan if the loan becomes a loss to the private institution. Again, the reason is to get private sector involvement toward a desirable end without requiring personnel from the federal government to make the loan and without requiring large appropriations for the loans. The loan guarantee approach can be effective in reaching large numbers of farmer borrowers because of the numerous private lenders serving the sector. This approach does invite private lenders to shift their worst loans to the public sector. This effect can be diminished, however, by limiting the guarantee to a fixed term. The program is relatively hidden from public view. Structural implications of loan guarantees depend upon the nature of the qualifications for the guarantees. If such guarantees are limited to small or low resource farmers, then the structural implication can favor small farms. However, without such restrictions the loan guarantees would favor larger rather than smaller farms because of the disproportionate use of credit on large farms.

7) Public ownership of farm land

Public ownership of land refers to a policy that would require Farmers Home Administration, when foreclosing on mortgages, to hold the land (i.e. keep it off the market) until the downward pressure on land values eases. FmHA might be required to hold land for a period of one, two, or three years, or until some characteristic of the land market signalled that it had stabilized.

This approach has limited potential although it could be quite helpful in counties where there is extensive financial distress. The policy would ease downward pressure on the land market, and this is the main reason for such a policy. Yet, it would be very expensive for FmHA or other lenders to hold land out of production since holding costs, i.e. taxes, insurance, and interest, would be in the order of 12% to 20% per year. If land were not kept out of production (this would likely be the situation for most of the land), then production of commodities nationwide would be little affected. Downward pressure on commodity prices would not be eased by the policy. While the amount of land held in this form nationwide would likely be no more than one or two percent of total farmland, the amount could be substantial and very helpful in some severely impacted counties. Further, it seems likely that lenders holding land off the market would attempt to get the highest possible interim rental return. Hence, this land would be available for rental. Such rental would likely go to those with large scale, underemployed equipment--probably larger than average farms. Program costs, of course, would accrue to the public sector.

8) Private lender ownership of farm land

Private lender ownership of farm land will take place as these lenders foreclose or agree to take over land ownership as a part of voluntary borrower liquidation. The rationale as with FmHA ownership is to stabilize the land market and protect it from "dumping." The issue is what public policy should be toward land ownership by institutions in these cases. Should they be encouraged to hold land off a "soft" market? Will they have the liquidity to hold, in some cases, a substantial amount of such an illiquid asset? If

private lenders do hold land off the market to help stabilize that market, how and when will the proper time to sell be recognized?

While bank regulations typically require that real estate assets taken over by the bank be valued at market, some state banking regulators require further annual writedowns (and associated loan losses) to discourage holding of such assets. In fact, one of the factors currently causing problems in some states is the extreme position taken by state banking examiners.

Still another difficulty with private lender ownership is that some states prohibit ownership of farm land, and these prohibitions may be applied to certain, perhaps all, banks if they were to hold land for anything beyond immediate liquidation.

To implement a policy encouraging lenders to hold land off the market would require state involvement at a minimum, and perhaps even federal authorization and guidelines. A necessary part of this should come through the Federal Reserve System whose help will be needed by some banks if they are to hold farmland assets. As a minimum, banks may need extended credit from the Federal Reserve discount window to maintain liquidity.

Costs of a private lender land ownership program would be borne primarily by private lenders through the lower earnings on these assets during the holding pe . However, some of these costs would substitute for losses that would otherwise have occurred if the acquired properties had been sold on a depressed land market. Several key analysts believe this approach has significant potential for the current situation.

9) Debt restructuring

Debt restructuring refers to the rescheduling of loan commitments. Debt may be restructured by rewriting short-term or intermediate-term debt to a long-term basis if the collateral justifies such change. Amount paid per year is then reduced. Without sufficient additional long-term collateral, debt restructuring is limited to rescheduling each class of loans--short, intermediate and long term--over a longer repayment period. Also, if the debt is on a fixed interest rate basis and interest rates have declined, then the

debt might be rescheduled in part to take advantage of lower interest rates as well as to obtain a longer repayment period.

The rationale behind restructuring is that debt service requirements per year are reduced if one takes longer to repay the loan. That is, less principal is paid per year and, therefore, the debt service cost per year is less.

The effectiveness of debt restructuring depends upon the nature of each borrower's debt situation. For those borrowers who have a high proportion of their total debt on a short or intermediate term basis, substantial improvement in debt service requirements can be had by restructuring to a longer term pay-back. Interest rates, however, have a lot to do with the potential effectiveness of debt restructuring. One must typically pay at least interest, and therefore debt service will always be higher with 14% interest rates than with 10% interest rates; but, there is still often some potential for reducing the debt service requirements by restructuring to pay less principal per year. Probably in the current period of financial stress, however, most of that voluntary debt restructuring has already taken place. There are practical limits on how much short term debt can be shifted into a longer payment mode. To help encourage as much lengthening of payments as possible, some policy proposals have required debt restructuring as a prerequisite to federal government guarantees.

Debt restructuring can be done by lenders on a voluntary basis. Requiring that they do so is difficult unless the government provides some positive benefit to the private lender. Such benefit could be either in the form of guarantees or a loan "buy out" by the government after some period of time if the loan turns sour. Structural implications of debt restructuring would appear to be neutral. Costs are nil.

10) Write down of loans

A write down of loans means to reduce or write off some of the principal outstanding. It is important to note whether the write down occurs only on the lender's books or whether the borrower is also informed of the write down of the principal. The

first may be required by bank examiners; the second is a forgiveness on part of the principal. A write down of the loan on the lender's books without loan forgiveness to the farmer is of little help. A write down (forgiveness) of loan amount, for example, recognizes that the value of the asset has fallen below the loan level and that the farmer's cash flow does not permit repayment on the present schedule. A write down might be used as a basis to reschedule principal and interest payments in line with lower asset values and thereby to ease the debt service requirements. This approach can be quite beneficial to the farmer borrower. Whether it will be a complete solution depends, of course, on how much the debt service burden can be reduced in relation to the income stream coming into the farm operation.

Writing down loans is an approach that can be utilized by both public and private credit agencies. It can be done administratively; but for widescale application, legislation would probably be required. A limiting factor for write downs by private lenders is the relatively low equities such lenders have. Most private lenders, for example, have an equity base of between 5% and 10% of their assets. These assets, of course, consist primarily of loans; hence, a 10% write off of all of their outstanding loans would typically make the lending institution insolvent. Applied in a voluntary way, loan write downs create equity problems among borrowers served by the same lending institution. If one borrower hears that a neighbor has received a substantial write down on his loan, ill will may be created. Write downs of loans by a federal lending agency are a relatively costly approach to solving farmer financial stress. The limits on this approach, then, would seem to be in terms of costs to the government or costs to the private lenders of writing down their poor quality loans. Farm structure implications would depend on how the program was applied and the target group. If the program were initiated only by, or primarily through, FmHA, it would likely favor smaller farms.

11) Interest "buy down"

An interest "buy-down" would involve an interest rate reduction on an existing loan. The buy down designation comes from the idea that the federal government would pay a part of the cost of interest rate reduction to private lenders who are willing to reduce the interest rate. For example, if the farmer's loan were at 14% and the debt burden were unserviceable at that rate, then the federal government might implement a 4% buy down, that is, decrease the interest rate to 10%. Half of the cost might be borne by the government and the other half by the private lender. The proportion of cost sharing, of course, could be other than 50/50. If the government pays the full cost of the interest rate reduction, then the interest buy down becomes an interest subsidy.

The rationale behind an interest buy down is to reduce the debt service requirements which are directly related to high rates of interest.

The effectiveness of an interest rate buy down in terms of help to farmers is in direct proportion to amount of the buy down. This approach does recognizes that a major factor contributing to current financial stress is the high interest rates on farm loans. The question that cannot be answered directly is how much interest buy down would be needed to provide an effective solution to the problem. Given that late 1984 real rates of interest, that is, interest rate in excess of the rate of inflation, were near 9% and that a more typical real interest rate relationship is 3% to 4%, an interest rate buy down of five or six percentage points has some conceptual basis. (It is, of course, the loan interest rate that creates cash flow problems not the "real" rate.)

An interest buy down, like an interest subsidy, while it is relatively effective in dealing with the problem, is also an expensive solution. A buy down would apply only to private lenders since government costs would be involved in encouraging private lenders to utilize this approach. By lowering net interest rates to borrowers, land value decreases would be moderated and basic revaluations of capital in the sector would be slowed or

halted. The concept of direct government expenditure to buy down interest rates on loans of a segment of the population would likely be viewed negatively by the general public.

The interest buy down approach does have structural implications depending upon how it is applied. A straightforward interest rate buy down on all loans to a specific level would have advantages to larger farms rather than smaller farms because of debt distribution. One specific proposal within this overall approach would limit the amount of buy down in a manner that smaller loans would have a bigger percentage reduction in interest rate than large loans. This latter approach would have structural implications in the direction of favoring smaller farms rather than larger farms.

12) Tax free interest on special government bonds

Tax free interest on "special purpose" bonds to raise funds for lending to the agricultural sector would make funds for agriculture available at a lower interest rate. Presumably, this approach would be to raise funds for FmHA use so that the purpose could be tied directly to relief of financial stress in the farming sector.

The experience in raising funds using industrial development bonds with similarly tax exempt interest would suggest that there might be a two or three percentage point lower interest rate advantage to such bonds. This lower interest rate could be passed on in the form of lower interest rates to farmers qualifying for this special program. If such funding were available only through federal agencies, then the effectiveness in terms of numbers of farmers reached would be reduced compared to general availability. Further, while a two or three percentage point drop in interest rates would be helpful, it would not solve fully the financial stress problems of most farmers; but, of course, it would make a difference for some proportion of the total farm population in financial stress. Initiating such a program would overburden personnel in FmHA. Unless a means were available to share benefits with private lenders, it would be of little help to their borrowers. As with other government programs, there would probably be a tendency for private lenders to

shift some of their poorer credits into this program as a means of salvaging some of their low quality loans.

The cost of this program, however, would be shifted to the general public through reduced tax revenues. It would be less visible than direct government spending in FmHA programs. Structural implications would depend on criteria for loans. If incorporated into FmHA programs, it would favor smaller farmers. If criteria for loans were, instead, not limited except for conditions of financial stress, the approach would be neutral to favorable toward larger farms since a disproportionate number of larger farms is highly leveraged. Also, implementation of such a program would require legislative authorization.

13) No "special" policy

If no special policy is implemented to deal with the current financial stress of farmers, the adjustments, difficulties, and financial stress of the sector now evident can be expected to continue. How long it will continue depends on when incomes are markedly improved or interest rates are substantially reduced. Without either a substantial increase in incomes or a substantial reduction in interest rates, farm land values and other durables used in farm production can be expected to remain depressed, perhaps even to decrease further in price, in turn weakening individual farmer balance sheets, causing additional loan losses to lenders, and continuing to force farmers out of business.

Direct public costs of doing nothing are low. Social and indirect costs may be high. Additional lenders can be expected to fail, and this will bring distress to rural communities. Often, when a lender fails, the borrowers are without a lending home. In the current environment, it becomes difficult to find a new lender unless the farm firm has a very strong financial statement. Iowa experience with FDIC liquidations of banks suggests that the real problems are not those of depositors but rather the homeless borrowers who find it difficult to re-establish a credit relationship. It is, of course, impossible to put numbers on such statements. It does seem unlikely that the situation, in

terms of farm numbers or proportion of farmers affected, will be as serious as the 1930s. Also, given the high proportion of the debt owed by operators of large farms, the structural implications of no special policy would be less harmful percentagewise to smaller farmers than to large farmers. Nevertheless, large numbers of family or low resource farmers would be affected.

Summary of Short Term Credit Policy Approaches

Table 1 represents an attempt to assign relative weights to the various special policy approaches with respect to effectiveness, degree of government involvement (including staffing requirements), public cost, private lender cost, applicability to numbers of farmers, and structural implications for large versus small farms. One general conclusion is that the more effective such policies are likely to be in solving current stress the more costly they are likely to be and the more likely they are to require substantial involvement from some government agency. Further, it appears that the more effective programs are likely to be applicable to relatively few farms since it is expected that the programs will be targeted to specific groups. There will likely not be sufficient resources to reach all affected farmers.

Note also that none of the programs is rated at a high effectiveness level if the financial stress problem of farmers is, in fact, a long term problem. That is, if farm income should remain at 1983-84 levels or drop further and if market interest rates remain near 1983-84 levels over the next five years, the proposals will ease the adjustment but will not improve the fundamental relationships. This simply recognizes that a major part of financial stress is related to relatively low farm incomes in a period of high interest rates. Asset values were forced lower because of the income-interest rate relationship. Hence, without improvement in income or interest rates, the debt loads are excessive. Individual balance sheets will likely continue to weaken. So, if neither income nor interest rates improve over the next five years, none of these programs will have been very effective in preventing failure of unusually large numbers of farmers or in

reducing the unusually large loan losses of financial institutions. Longer term solutions must come from national economic policies or markets.

Evaluation of national economic policies is beyond the scope of this paper. Two general economic policy approaches do merit mention nevertheless. One which will undoubtedly receive attention is price and/or income supports for the agricultural sector. The disadvantage of farm price supports as usually applied is that U.S. agricultural commodities would continue to be overpriced in world markets. Price supports do not make our commodities more competitive. Instead, by pegging prices at above-market levels, land and durable values would continue to be overpriced in relation to their true productivity in free markets. Furthermore, price support progams are typically not targeted well since payments are a function of volume of production or size of farm rather than of financial condition.

A second general economic policy which impacts agriculture is monetary. The important effects of monetary policy on agriculture both from high interest rates and international exchange rates need to be recognized. A fiscal policy consistent with monetary policy would also be helpful. In short, the current problems of financial stress in agriculture can only partially be addressed by specific short term credit policies. Emphasis is also needed on national economic policies.

Finally, one other aspect deserves parting comment. One column of the table suggests what relative direct costs to private lenders might be for various programs. An important issue in considering the various programs to relieve short term financial stress of farmers is the effect on lending institutions serving those farmers. In some Corn Belt-Plains states, and to a lesser extent in some other parts of the U.S., lending institutions have taken substantial losses, and their financial structure has been severely weakened. Should the current financial stress continue or worsen, failures of financial institutions serving the agricultural sector may get as much or more attention than the failure of individual farmers. Unless markets or public policies provide some help to farmers in

extreme financial difficulty, additional numbers of farm lenders will experience financial problems.

Implications for Technology Adoption and Structural Change in Agriculture

There are two aspects of the present situation that impinge on the adoption of technology and structural change in agriculture. One is the effect of the current financial stress in comparison to more normal times. The other is the effect of policies that might alleviate the financial stress as discussed earlier. Both of these will be considered in the discussion that follows.

1) Adoption of new technology

The key element in the adoption of new technology concerns the form of the technology. Two specific types of technology need to be differentiated. One is the new technology requiring a major capital purchase such as, for example, robots, mechanization, automated controllers and sensors, and the like. Such technologies, in effect, are durables and require a major outlay of capital which presumably will return benefits over a number of future years. Such technology requires major capital investments; and for farmers not having capital on hand, purchase would require substantial amounts of credit.

A second category of new technology which needs to be differentiated from the first would be technology that is incorporated into annual operating inputs. Examples might be hormones, special feed additives, new varieties of seed, etc. Such technologies are purchased out of current year's operating expenses. While they might require some modest use of operating credit, that credit would be repaid from the increased profitability within the year.

Periods of severe financial stress, such as 1983 and since, affect the rate of adoption of the first type of new technology, i.e. capital durables. In times of financial

stress, lenders will emphasize the paydown of loans. They are less interested in financing major new investments for purchase of new technology--especially technology that requires several years for repayment. While some of the short term credit policies for relieving financial stress might improve the situation marginally, new technology requiring major new investments with payoff over a period of years will be adopted slower than in normal times by those farm operators who are already highly leveraged. For farmers not experiencing financial stress, adoption rates for new technology would be little affected.

Adoption of new technology that is purchased and used up within the production period would be less affected. Even in periods of financial stress, lenders provide farmers with credit for operating expenses, though the line of credit may be reduced. The delay in adopting this type of new technology would be expected to come from lack of information on the technology rather than from restrictions on capital or credit availability. Farmers in severe stress may well focus more on means for surviving rather than studying new techniques and new knowledge that would improve the farm in the longer run. Short term credit policies to alleviate financial stress would, if anything, permit faster adoption of this type of new technology. With less concern for financial survival, farmers could put more of their attention on learning about new techniques, new inputs and the like.

2) Size structure of farms

Severe financial stress has implications for the size structure of farms. Given the nature of the current financial stress with a higher proportion of larger farms more heavily indebted than medium size or smaller farms, the current period of financial stress may slow trends toward increasing size of U.S. farms. Unfortunately, however, we do not have very good data on this relationship. Some evidence suggests that many highly leveraged, large farms are doing very well. Probably the trend toward larger farms will not be reversed because there still are some underlying reasons for that trend. Yet the higher proportion of larger farms that are heavily indebted means

that a large number of those farms will fail or will have to sell assets to gain liquidity. A second important contributor to slowing the trend toward larger farm operations is that large farm operations tend to emphasize rate of return and profitability. In this period of low returns and low profitability, there may be a less clear economic incentive to push toward larger size, especially if that expansion has to be debt financed.

The various specific policy approaches to dealing with financial stress discussed earlier would have varying effects on the size structure of farms. Interest subsidies, if broadly applied, might favor larger farms; but if targeted to smaller farms, would favor those. However, many of the proposals would likely be targeted toward small or medium size farms making them less available to larger farm operations.

To the extent that policy approaches or market conditions alleviate the current financial stress situation, adoption of new technology would proceed in a faster manner; and as is typical of new technology, it would likely have a size/structure effect of favoring large farms more than small or low resource farms. This is, in part, due to the ability of larger farms to purchase the technology, the typical higher applicability to larger farms, and also to the faster rate at which large farms adopt new technology to improve profitability and rate of return.

3) Market structure of farms

The current financial stress has already had important implications to the market structure of farms. A number of input suppliers have failed; hence, input suppliers on the average are larger and more distant from farms than earlier. The same type of change is likely taking place in markets where farm products are purchased. The financial stress of farmers may lead to a reduced number of firms purchasing output of farmers. Such changes have certainly been true with respect to the number of grain elevators, the number of wineries purchasing grapes from farmers and the number of milk processing and manufacturing plants.

Policies to alleviate current financial stress of farms will have effects on the market structure serving farmers. Bankruptcies of farmers hit input suppliers and trade creditors much harder than conventional lenders. Financial help to farmers would clearly improve the short term survivability of rural agribusinesses.

4) Financial structure of farms

The current financial stress of U.S. farmers is severely weakening the financial structure of farms. The degree of weakening is shown by the debt/asset ratio of each farmer's balance sheet. For those farmers with few debts or no debts, reduced asset values are reducing net worths, but those farms are typically not in danger of failure. For highly leveraged farm operations with 50% to 80%, or higher, debt/asset ratios, reduced asset values have a multiplier effect on individual balance sheets. In some instances, net worth has disappeared, or will disappear. In other instances, there would be little net worth left after selling out the farm business. Without improvement in commodity prices or interest rates, the situation will likely continue to deteriorate. Rates of return on assets are simply not high enough to offset the interest costs on loans for highly leveraged operators. In a period of high interest rates, carrying costs of assets, inventories, etc. become extremely expensive. Waiting for the situation to improve simply allows carrying costs to eat up equity.

The short term credit policy approaches discussed earlier could ease the financial stress of farmers in the short term. They could help to ease the transition and stabilize asset markets. The bulk of direct benefits apply to those farmers targeted for special policies. Those policies applicable to relatively few farmers would have less effect on financial structure than if the policies were widely applicable to large numbers of farms over the whole range of farm size. As one result of the current financial stress, lenders are expected to be more conservative in their farm lending. They will lower their rules of thumb of safe debt/asset ratios, and they will put more emphasis on cash flow repayment capacity for loans. Lessons of the 1930s, relearned in the 1980s, will likely once again

require that balance sheets in agriculture show more liquidity and more equity than was true in the late 1970s.

5) Tenure structure of farms

As indicated above, the current financial stress and the factors responsible for the situation have pushed land values downward and have weakened the markets for used machinery, cows and similar durables. This lowering of basic farm input prices makes asset acquisition less costly for high equity operators or prospective new entrants who have substantial net worth available to supplement debt financing. Hence, one of the expected outcomes of reduced farm asset values is for operator ownership of land to rise.

An alternative view is that non-farm investors, rather than farm operators, will purchase more of the land. This analyst, however, disagrees with that view since a 7-9% return on assets in farming with, if anything, depressed income prospects for the next several years just doesn't represent a high priority investment for nonfarmers. Also, we see farm rental becoming increasingly important as a capital control alternative when farmland values are rising rapidly. Why shouldn't we expect a higher degree of owner-operatorship when land values fall rapidly? Still further evidence in this direction is that renters of farms in the Midwest have been especially hard hit by the current financial stress as shown, for example, by the Illinois FBFM farm records.

Changing tenancy patterns need further evaluation. Are institutional arrangements keeping pace with the current rapid changes in the economic environment of agriculture? Under current institutional arrangements in much of the U.S., tenants frequently only have short term leases and few property rights compared to landlords. To obtain increased acceptability of tenancy as a vehicle for controlling agricultural assets, institutional changes in leasing arrangements are likely needed.

Some of the special credit policy approaches discussed earlier would help to ease whatever transition and changes occur. The adjustment process could continue but with less stress and less volatility in market prices of assets. Without credit or appropriate,

flexible leasing arrangement policies to moderate the rate of asset value changes, it seems likely that some asset markets in some areas will see the "bottom fall out" in a manner detrimental to farmers, lenders and rural communities.

6) Legal structure of farms

A continuation of current financial stress would likely lead toward increased ownership of farm land by lenders who are in process of foreclosing the borrower. Beyond that, it is difficult to analyze potential changes. As land values drop, land investment looks more favorable to high equity farmers. Perhaps there would be some slight decrease in proportion of land owned by corporations since stockholders and directors are likely to be disappointed in farm earnings prospects. Whether farm partnerships would change in number proportionately depends upon whether they recently expanded and took on large amounts of debt. If so, they may have to close out. The proportion of businesses run as sole proprietorships is similarly hard to interpret because the overriding factor affecting financial difficulty is the debt service burden and not the type of legal structure of the farm business.

Table 1. Subjective Ratings of Alternative Short Term Credit Proposals

Proposals	Implementation Requires L,A,V[a]	Effectiveness in: Short Term[b]	Effectiveness in: Long Term[c]	Degree of Govt. Agency Involvement (FmHA)	Public Cost	Private Lender Cost	Help Large Nos. of Distressed Farmers?	Favors Large or Small Farmers? (3 is neutral)
				Ratings[d]				
1) Forbearance	V	1	0	1	1	2	5	3
2) Moratoria	LA	2	1	3	2	3	1	2
3) Waiver of interest	LAV	4	1	3	3	3	3	3
4) Deferral of int./prin.	LAV	4	1	2	2	2	2	4
5) Interest subsidy	L	4	2	4	3	1	1	4
6) Public credit (EE, etc.)	LA	3	1	5	2	0	1	2
7) Public land Ownership	LA	1	0	3	1	0	0	4
8) Pvt. lender own. of land	LA	3	2	2	1	3	2	3
9) Debt restructuring	AV	3	2	3	1	1	4	3
10) Write down of loans	LAV	4	2	4	5	4	1	2
11) Interest "buy down"	L	4	2	4	4	4	1	2
12) Tax free interest on bonds	L	2	1	2	2	0	2	3
13) No "special" policy				0	0	0	0	2

a/ L means legislation required, A means administrative action required, V means voluntary action could implement.

b/ Short term assumes farm incomes increase 50% or more or that interest rates drop by 1/3 or more (prime 8½% or less) within 2 years.

c/ Long term assumes at least 5 years before either a 50% or better increase in farm incomes and/or a 1/3 reduction in interest rates occurs.

d/ Scale is 0 to 5 where 5 is large, high or yes and 0 is low, none or no.

References

Alston, L. J. Farm Foreclosure Moratorium Legislation. Am. Econ. Rev., June 1981, pp. 445-457.

Brake, J. R. Aggregate Production, Income, and Financial Effects of the 1980-83 Recession in Agriculture. Cornell Agricultural Economics Staff Paper 84-19, August 1984.

Breimyer, Harold F. Food for People and Profit: Ethics and Capitalism--an Alternative Interpretation, No. 6 in The Farm and Food System in Transition, Cooperative Ext. Serv., Mich. State Univ., 1983.

Dorow, Norbert A. The Farm Structure of the Future: Trends and Issues, No. 17 in The Farm and Food System in Transition, Coop. Ext. Serv., Mich. State University, 1984.

Knutson, Ronald D. Farm and Food Policy--An Overview, No. 3 in The Farm and Food System in Transition, Coop. Ext. Serv., Mich. State Univ., 1983.

Lee, John E., Jr., Stephen C. Gabriel and Michael D. Boehlje. Public Policy Toward Agricultural Credit, in Future Sources of Loanable Funds for Agricultural Banks, Federal Reserve Bank of Kansas City, 1981, pp. 83-106.

Melichar, Emanuel (1984). Farm Wealth: Origins, Impact, and Implications for Public Policy, A.E. Research 83-40, Dept. of Agr. Econ., Cornell University, 1984.

Slater, Susan. The Federal Government's Role in Rural Financial Markets, in Rural Financial Markets: Research Issues for the 1980s. Federal Reserve Bank of Chicago, 1982, pp. 150-158.